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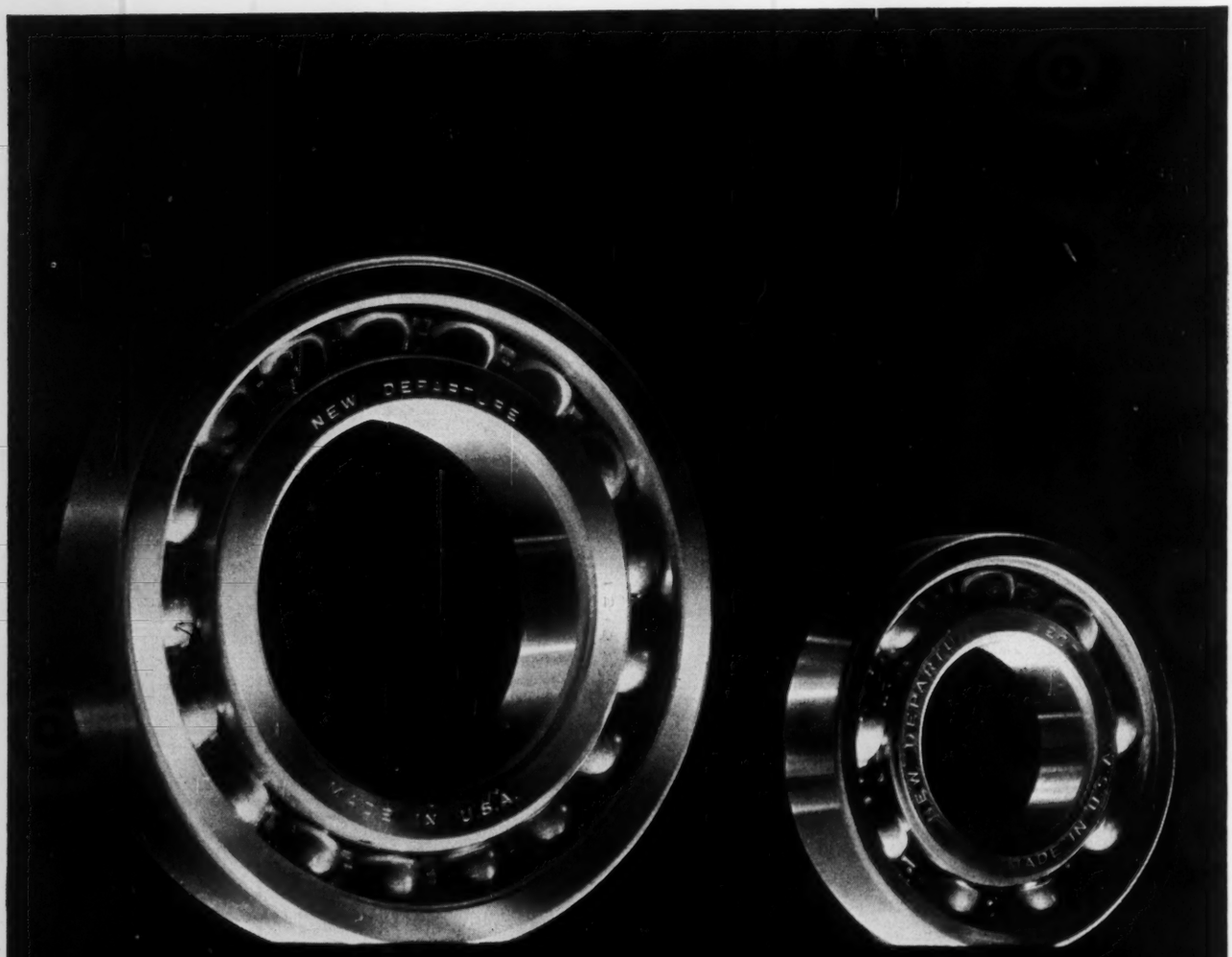

# UNIFORMITY—The Seed of Dependability

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# NEW DEPARTURE

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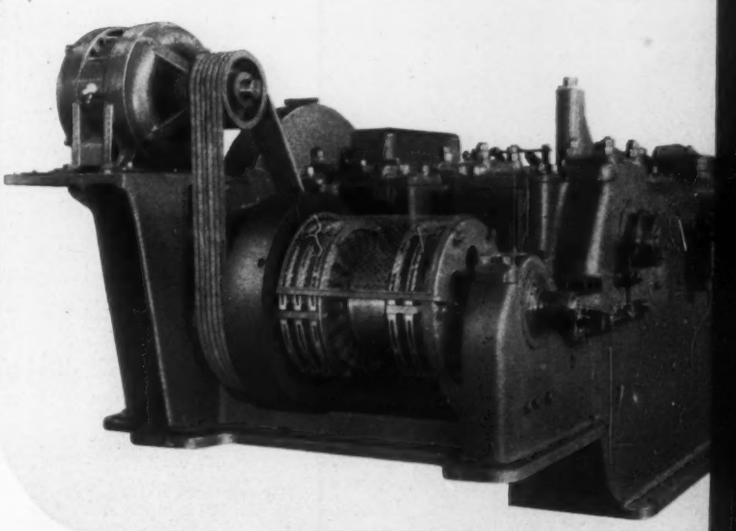
MACHINE DESIGN

# Deflection, Fatigue Eliminated in Huge Forger

By Merle W. Lamprecht
*Acme Machinery Co.*

Fig. 1—Front view of 200,000-pound upset forging machine. Work is forged in recess at right. Fig. 2—Rear view, showing cushioned drive, including motor, V-belt drive, flywheel, short air cylinder, driving and braking clutches



STRIKING advances in analyses and characteristics of metals today are demanding metalworking machinery with increased speed of operation and stronger, more complicated work pieces. Typical of the trend is the 200,000-pound hot upset forging machine in *Figs.* 1 and 2, made by Acme Machinery Co. This machine handles hot bars up to 5-inch diameter.

Bars are upset by a three-cornered jolt of a header slide and two gripping dies which operate at right angles to the head. One die moves, the other is stationary. The design of the sliding head and mainshaft assembly, shown in *Fig.* 4, is noteworthy for several reasons. These units fit into and operate the header slide.

Elimination of deflection under heavy stresses and counteraction of fatigue, were sought in the mainshaft, a heat treated alloy steel forging. Of the eccentric type, it permits a large bearing area in the sliding head and resultant lower pressures and little maintenance. Bearings are located closer to the center line than is possible with conventional types of crankshafts. Photoelastic stress analyses comparing this eccentric shaft with usual types have shown very little localization of stresses, whereas ordinary crankshafts

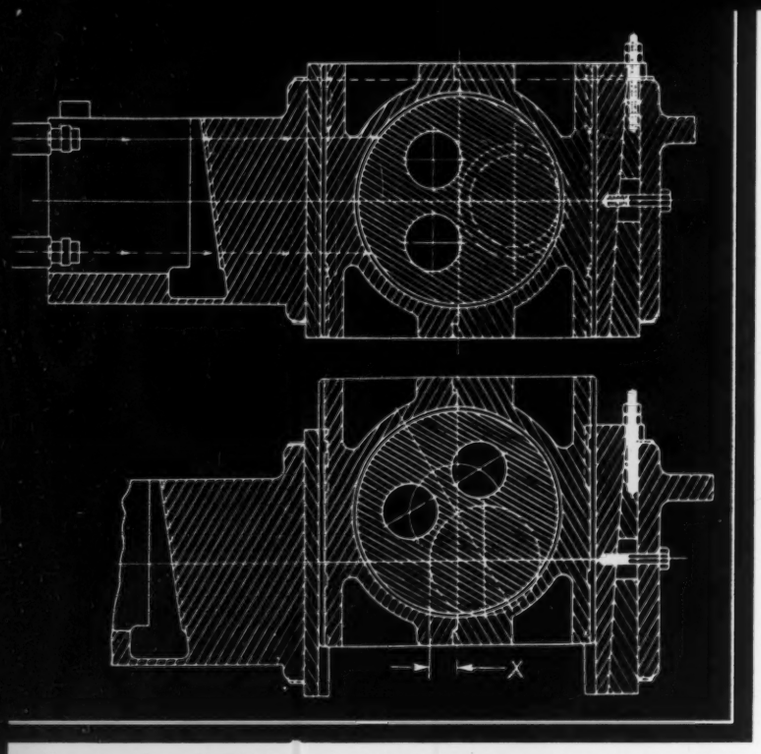



**Fig. 3—Movement of head slide from rest position at top to 30-degree travel of shaft at bottom. Because slide travels shorter distance than formerly, marked increase in power results. Shaft shows little stress localization**

reveal high localization. The results indicate ability on the part of the eccentric shaft to withstand 300 per cent more pressure.

As the illustration shows, the mainshaft turns in the sliding head, which in turn moves vertically in the header slide, which is fully suspended on both sides of the shaft and has horizontal surfaces in a single plane. The horizontal supporting surfaces are lined with bronze and slide on hardened and ground steel liners fitted to the bed. At the far right is an adjustable taper gib to take up wear on the sliding head surfaces and on the large eccentric bushing. The conventional pitman construction would require replacement of bushings after wear.

### Movement Increases Power

Movement of the sliding head, shown in cross section in *Fig.* 3, was designed to eliminate difficulties encountered with the former pitman type, with its small bearing area on the pitman pin. Power increase of 15 to 20 per cent is possible because the slide has to travel a shorter distance. *Fig.* 3 indicates as X the distance traversed by the slide in a 30-degree travel of the shaft. Because of the straightening out of the angularity of the pitman, the latter movement would travel *X* distance plus more than a quarter as much more.

Moreover, if heading tools are placed above the center line of the eccentric shaft there is no tendency for the front end of the header slide to raise, nor for the rear end to lift when tools are below the shaft center line. Hence accurate alignment of tools through the complete stroke cycle is assured. With a fulcrum point, such as a pitman pin sets up, these pressures are present. The eccentric, however, takes the pressure on its large arc. On the return stroke, the same wide bearing surfaces bring the slide back smoothly, another marked improvement.

On the other end of the shaft, beyond the sliding head assembly, are two flame hardened cams, operating against hardened and ground rollers. The larger cam actuates the toggle mechanism which closes the gripping dies, the smaller cam opens them. This toggle operation will be discussed later.

To drive the sliding head movement, a special "cushioned" drive was developed, *Figs.* 2 and 5. The heavy motor in *Fig.* 2 is mounted on a bracket which permits adjustment of tension in the V-belt. An air-operated mechanism is shown in both illustrations, although mechanical or hydraulic units are optional. One piston controls both the ventilated driving clutch and driving brake, eliminating necessity for a separate brake control.

In operation, a slight pressure on a foot treadle actuates the reach rod and releases air through a four-way valve and the illustrated pressure lines to the driving clutch, causing the machine to move through

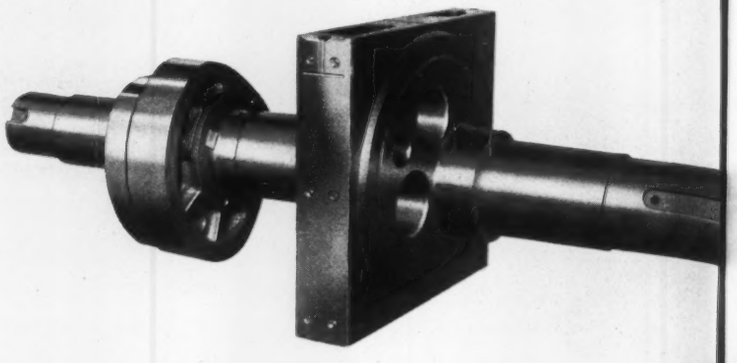


**Fig. 4—Assembly of suspended header slide and eccentric mainshaft. Large bearing area of latter reduces pressures and bearings are located closer to cente line. Cams actuate toggle mechanism which moves gripping dies**

its work cycle. The air cylinder is between the clutch and brake, as shown. Next to the driving clutch is the flywheel, the only rotating member when the machine is idling. On the end of the mainshaft is a cam arrangement which automatically releases air from the driving clutch to the braking clutch, stopping the head slide at the extreme back end of the stroke. Thus braking cannot come into action before the clutch is released. The machine starts instantaneously because no partial revolution of the driving gear or mainshaft is required before starting. Should the machine stall because of overload, the clutch cushions the stopping of the flywheel, eliminating shock to the machine frame, mainshaft or motor. Die setting is facilitated with air-operated clutches because the machine can be slowly inched through its entire operating cycle.

*Fig.* 5 shows at the left the double back gearing on

the machine, with outboard bearings for the pinion shafts. This double gearing provides a much greater gear ratio between the mainshaft and the flywheel, with resultant power increase. Gears are steel castings, pinions steel forgings, both with accurately cut teeth. As indicated in the illustration, tapered roller bearings are used on one pinion shaft, bronze plain bearings on the other. The flywheel also runs on massive antifriction bearings on the driving pinion shaft.

Earlier in this article, the two cams on the mainshaft which actuate the toggle mechanism of the gripping die slide were mentioned. This die slide is suspended like the header slide and the movable die is cradled in a hardened and ground plate attached to the slide. Hence the die may be adjusted, horizontally if necessary, to match the position of the stationary die.

### Cam Straightens Toggles

Movement of the cam on the mainshaft causes two pairs of double toggles to straighten out and move the die slide toward the stationary die. Co-ordination of this movement, at right angles to the header slide, is accomplished neatly because the eccentric shaft and cam move simultaneously. The double toggles take the gripping pressure through compression, hence no torque is taken from the upsetting action by the die slide. Any tendency of the dies to open is eliminated by the toggle construction.

An interesting safety device is incorporated to prevent accidents if any object should be caught between the gripping dies. In *Fig.* 6, the spring normally keeps the toggle levers in a nearly straight alignment. But if an obstruction should hold the slide box stationary, the toggle levers instantly assume an angular position and permit the slide to run over the slide box. On the return stroke the spring returns the toggle levers to their normal position.

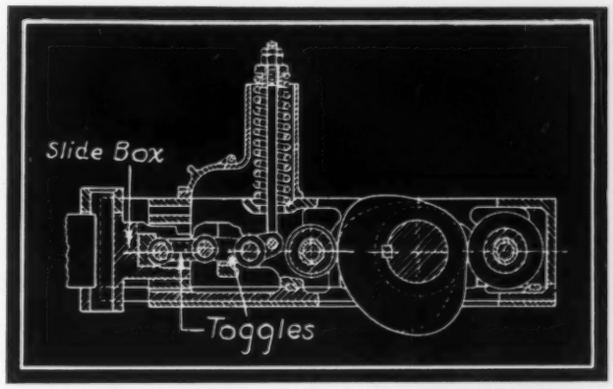



**Fig. 6—Safety device to prevent accident if object is caught between gripping dies. Die slide runs over slide box because toggle levers assume angular position**

Great strength is provided in the one-piece box type bed of the machine. A steel casting weighing 100,000 pounds is reinforced with longitudinal and transverse ribs extending beneath the floor line. Three large mainshaft bearings are split at an angle, confining most of the thrust stresses to the bed portion of the bearing. All wearing parts have removable liners or bushings, preventing wear on the bed itself. A pressure feed lubricating system is built into the machine, by which a measured amount of lubricant is forced directly to each bearing and wearing surface from one central reservoir.

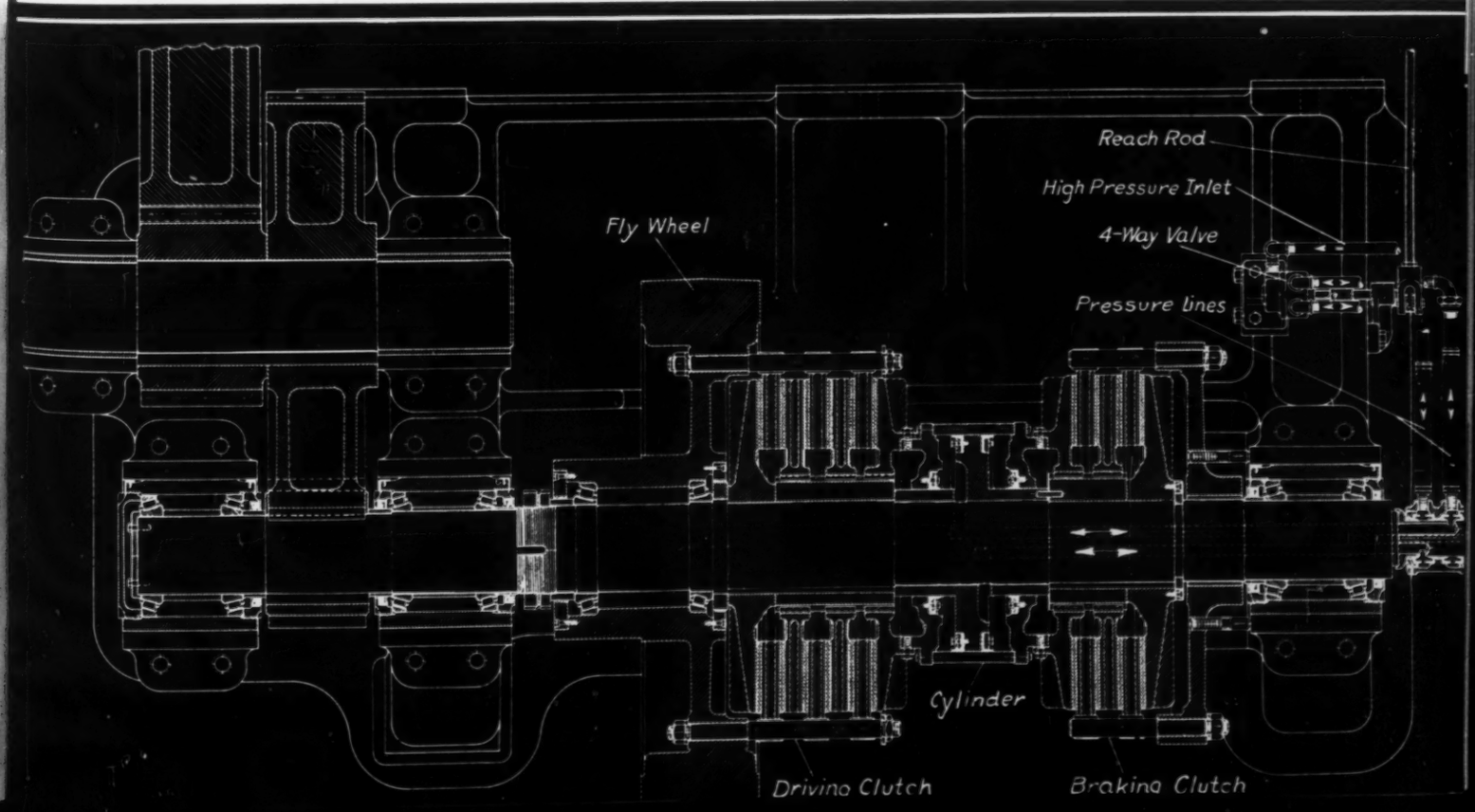



**Fig. 5—Below—Cross-section of drive, showing details of air pressure operation. Foot treadle actuates reach rod and releases air through four-way valve and pressure lines to driving clutch. Machine starts instantly**

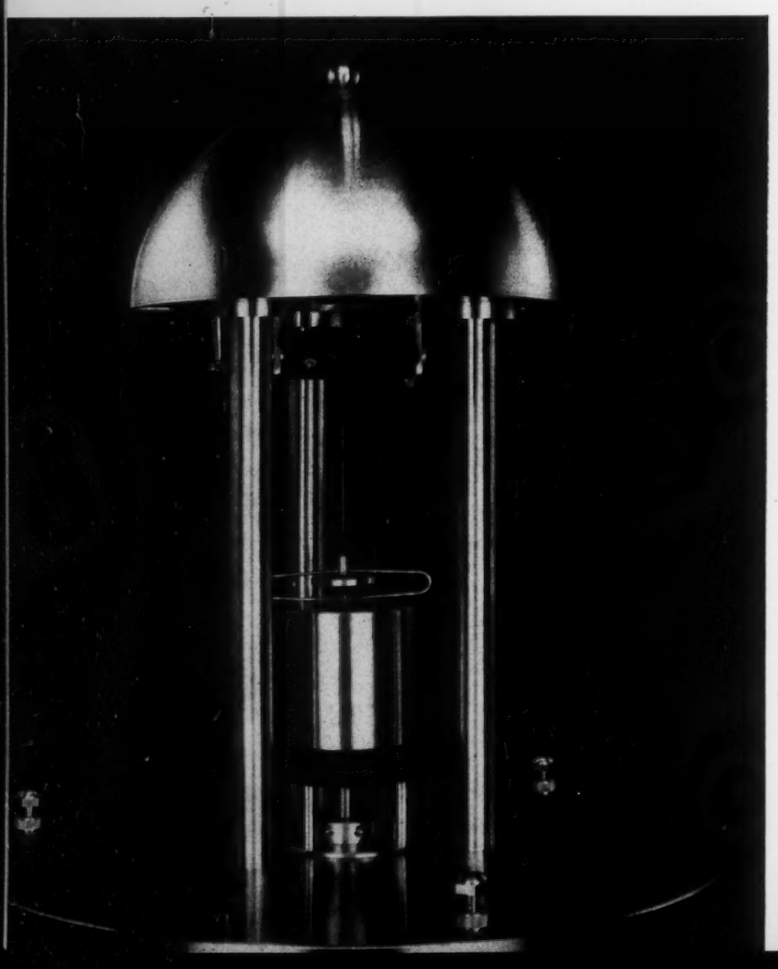
# Scanning the Field

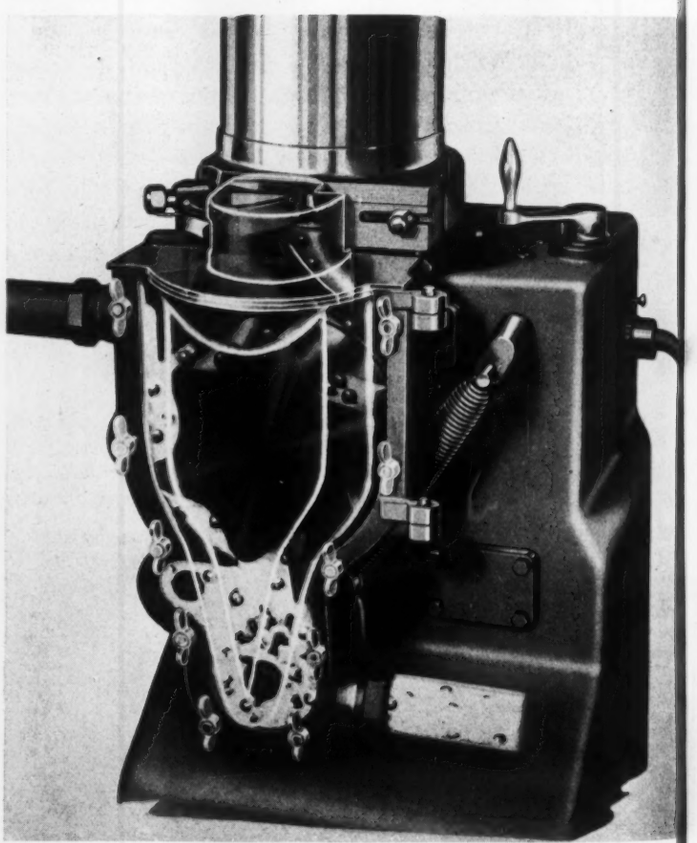
## FOR IDEAS

**Vibrations of a stretched wire** provide this secondary timing device with unusual accuracy, free from many of the objectionable features of previous mechanisms. Supported rigidly at its upper end and tensioned by a weight at its lower end, the wire is set in vibration through force supplied at its central point. This force is obtained from a permanent bar magnet in a simple vacuum tube connected to a plate battery supplied from a regular power circuit.

Temperature variations are compensated for by combining materials with opposite signs of temperature coefficients. Further corrections are obtained by varying gravity force of the weight for wire tension by a thermo-sensitive magnet or spring.

Energy required to keep the wire in vibration is less than half a milliwatt. Invented by Henry E. Warren, president, Warren Telechron Co. this device measures time with an error of less than one-tenth second a day. Driving telescope mechanisms is an example of the many applications for which this device is useful

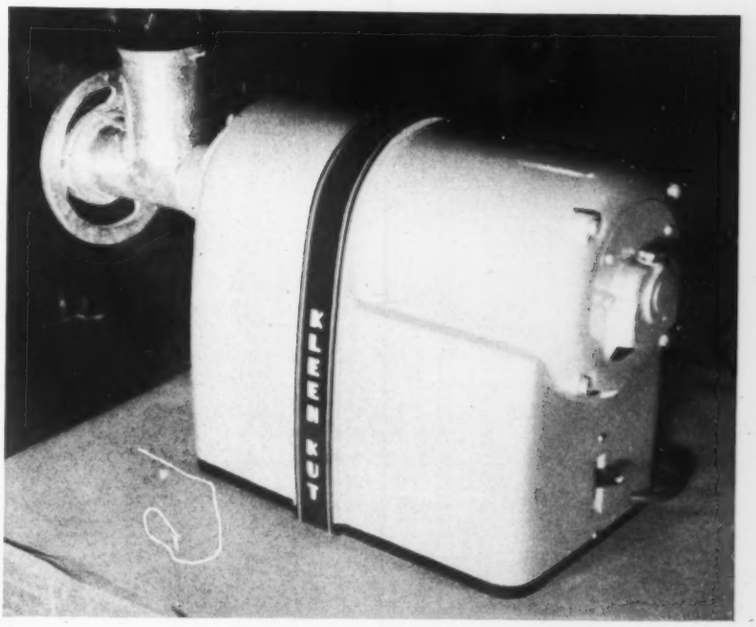


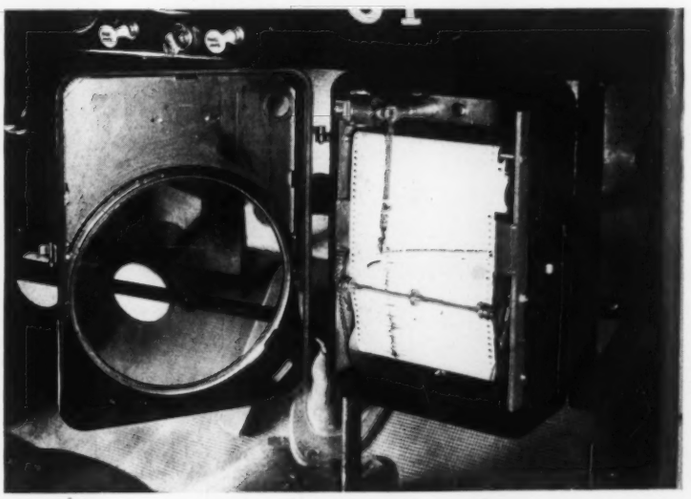


**Cam accurately mixes** solid particles with a semifluid product according to the proportions required. Folding admixtures into the product in this way, cherries, nuts and candies may be mixed with ice cream, for instance, without crushing or affecting the quality of the product. Developed by the Creamery Package Mfg. Co., a starwheel meters the delivery to the cam. The fruit is carried by the flow of ice cream to the bottom of the chamber where a mixing wheel makes a thorough distribution in this constant flow device

**Good design** involves maximum utilization of parts as well as production of pleasing contours. In this meat grinder, enclosure for the motor was obviated through designing the unit around the motor frame. Thus economies were effected by reducing the casting weight 35 pounds. Also, over half the motor itself is exposed giving greater heat radiation and as a direct result, greater motor capacity.

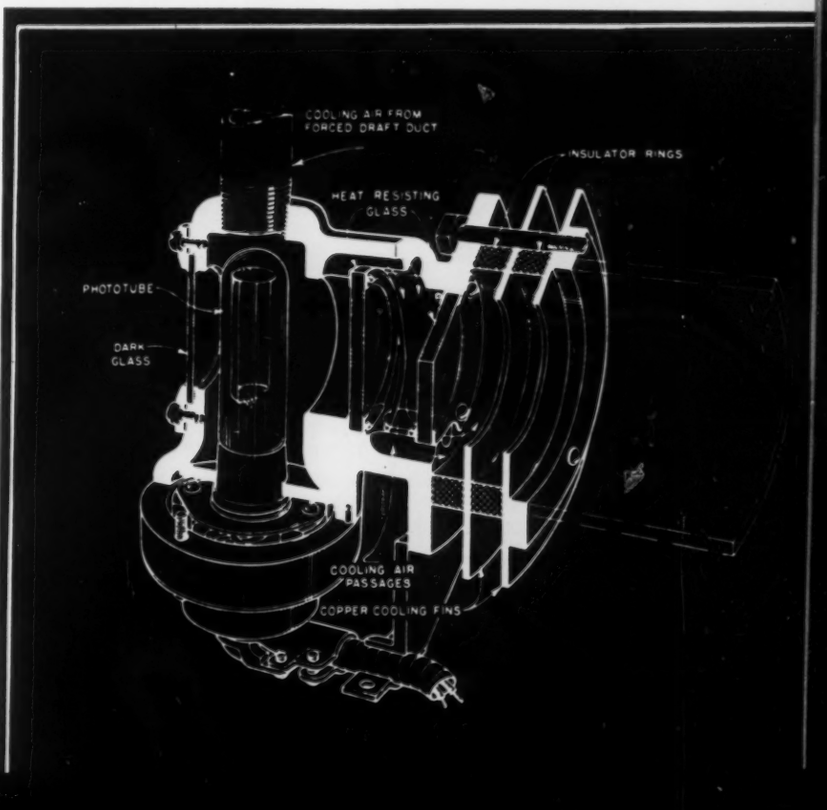
Casting body is bored to form a cradle for the motor. The four screws for the end brackets extend through the motor to fasten it to the casting and gear head within the unit. Two other screws hold the motor from the bottom. Motor and casting are sealed together by iron cement and filler, making them into one unit. This grinder was developed recently by the Kleen-Kut Mfg. Co.

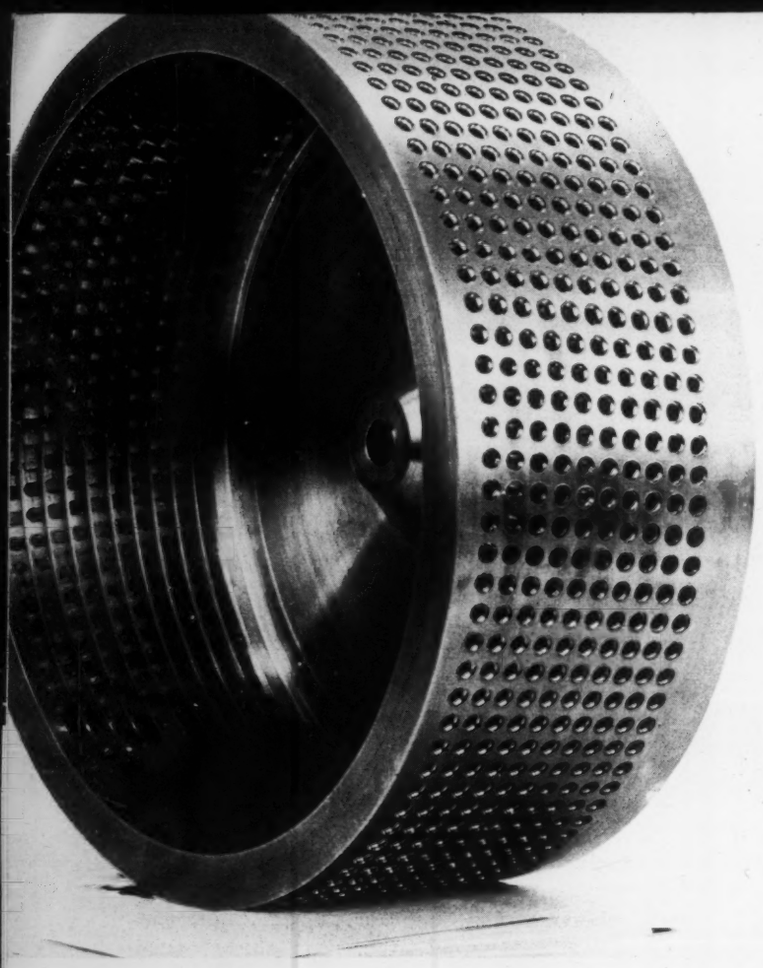


**Bumps per mile** are measured and recorded in this device designed by the Dow Chemical Co. to study surface roughness of highways in an effort to eliminate hazards produced by rough roads and resulting shock. Vertical motion of the car wheel is translated through a linkage system into oscillating motion of a shaft. This shaft controls pen arm by two cranks and connecting link, thus moving pen proportionally to relative motion of car and wheel. Pen movements, however small, are integrated by overrunning clutch operable in one direction

**By-pass air cools** this phototube flame detector for protecting oil fired equipment from possible damage resulting from faulty ignition. The cooling air is obtained from the forced draft system. This unit, developed by the Bailey Meter company, consists of a cast aluminum housing with two heat-absorbing glass disks to protect the phototube from direct radiated heat. Heat which might be conducted through the walls is dissipated by two copper cooling fins separated by insulator rings. Cooling air passes over the phototube, around the heat-resisting glasses and into the pipe sleeve. This stream of air serves the added purpose of preventing accumulation of dust on the tube or on one of the glasses



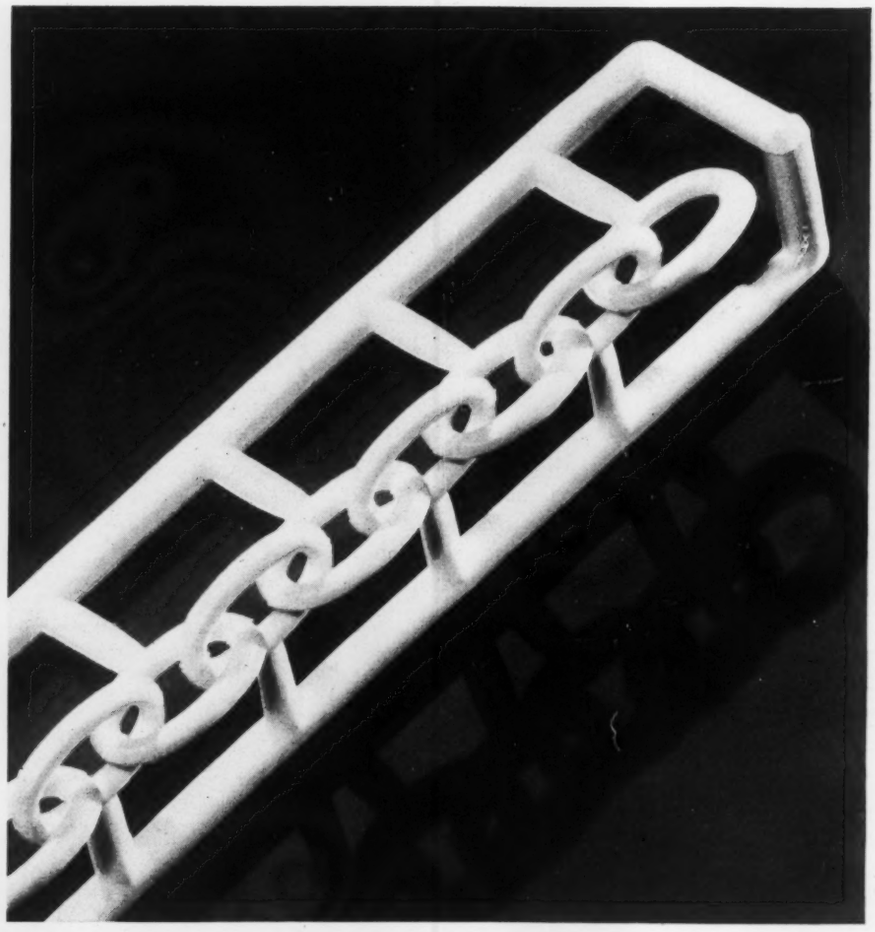


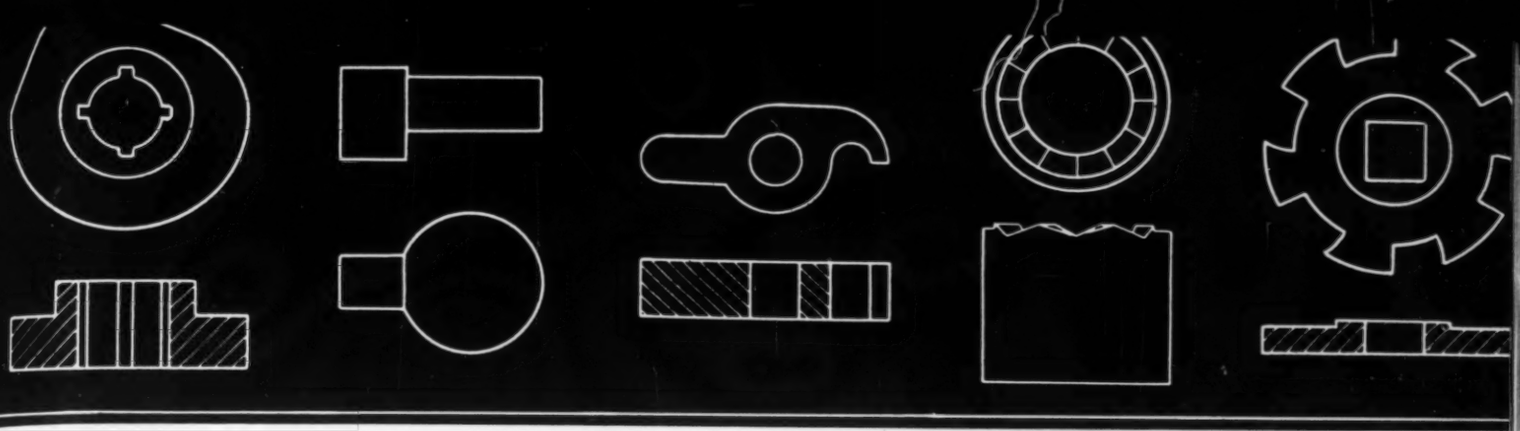
**Accurate position of holes** is responsible for the successful operation of this thousand-eyed pinhole camera. Progressively located around the drum in ten rows of one hundred holes each, every hole is a camera lens consisting of cemented-in small, black disks with .01-inch holes punched in their centers.

Carefully balanced, this heat-treated, manganese bronze casting operates at 7200 revolutions per minute, thus taking 120,000 exposures per second. Centrifugal action holds the film tight against the inside of the drum, one inch from the pinpoints. Developed by the General Electric Co. for taking pictures of circuit breaker operation, this high speed camera is unique in that it does not depend upon mirrors and other optical devices for scanning. Instead the film is rotated with its aperture past an adjustable collimating slot which controls exposures. This design may also be applied to other types of high speed photography where sufficient light is available

**Injection molding** is becoming an art capable of accomplishing the hitherto impracticable. Indicative of the refinements achieved is the cast chain of plastic for novelties. Molded of Tenite by Tilton & Cook Co., this chain is shown in the cast form with the runners attached. This design eliminates any cutting, threading, and cementing of the links. Each link is cast whole within its adjacent links. Severing the links from the runners of the casting is the only finishing operation required.

The chains are strong due to the toughness of the plastic and are light in weight. They come from the mold with a high polish taken from the finish of the mold. Intricate molding operations of this type will find wide applications to many fields including the chemical industries where acid resisting properties are required for equipment





# Powder Metallurgy Has Great Design Potentialities

By George Z. Griswold

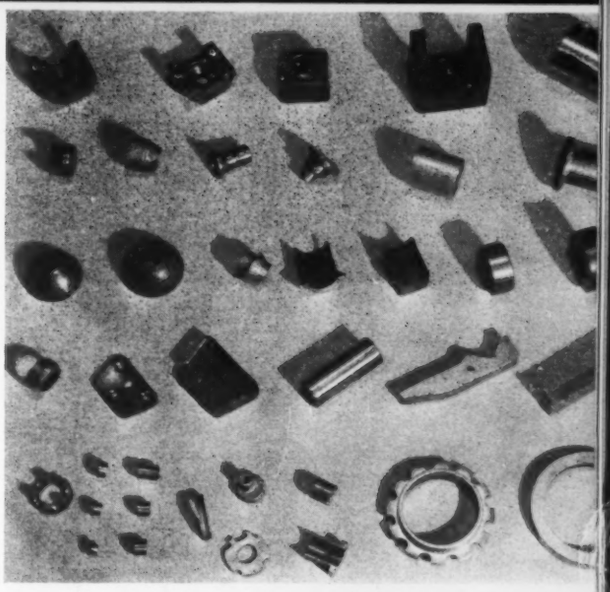
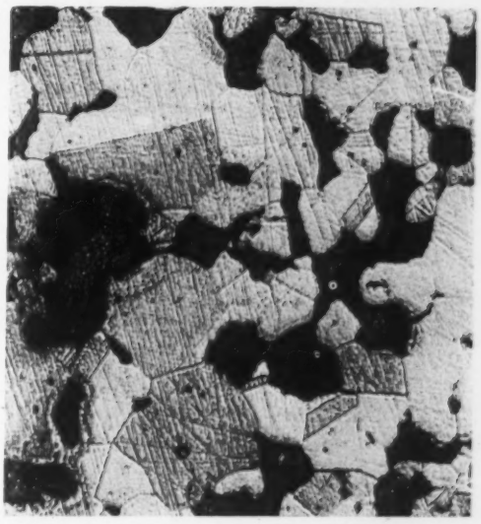


Fig. 1—Top—Representative outlines of the variety of exterior contours possible in powder metal parts. Fig. 2—Above—Typical parts, principally bronze and iron. Fig. 3—Below—Copper-tin structure and porosity of bronze are shown in this photomicrograph (magnification x 200)



POWDER metals have a great deal to offer designers because, like virtually every material, they possess peculiar qualities which permit them to be utilized in parts incapable of being produced otherwise, or in parts which cannot be made as well or as cheaply by other methods.

It is noteworthy, however, that although discussions of powder metallurgy were published as long ago as 1829, the science has remained relatively unexplored. A host of questions about metals in a powdered condition are unanswered, and until only a few years ago the variety of machine parts made from powder metals was very limited. As such applications expand, increased research undoubtedly will take place and fresh uses subsequently will be discovered. In the meantime, it is the purpose of this article to discuss the characteristics of powder metals which are bringing about their increased use in machine parts. Emphasis will be placed on design aspects of powder metallurgy, while actual production of powders and of parts will be mentioned only incidentally.

Advantages of powder metals from the standpoint of their application for machine parts are summarized in the following.

Powder metals permit fabrication of metals whose melting points are too high to enable easy casting. Tungsten, tantalum, molybdenum, columbium, platinum, etc., fall into this class.

Two or more metal powders may be mixed intimately so that they are bonded and have mechanical strength even though they are not alloys in the true sense and have hardly diffused into one another. At the same time, the individual and desirable qualities of each metal are retained by the whole. Electrical contacts and welding electrodes, for example, make use of metals with high conductivity (silver, copper) and others with resistance to fusion at high temperatures (tungsten, molybdenum, nickel).

Metals of great purity are obtainable if powders are used. Ferrous alloys particularly may become

vastly more useful if phosphorus, sulphur, carbon and nitrides are missing.

Combinations of metals and nonmetals may be effected which would be difficult to attain without powders. Cemented carbides, for instance, are hard because of tungsten (other hard metals may be supplementary ingredients) but a softer cementing element such as cobalt is needed to hold the combination together and to add toughness and resistance to shock. Again, porous metal bearings have graphite dispersed throughout the bearing metal. Copper and graphite powders are often combined to obtain the conductivity of copper and the lightness of graphite in current collector brushes on dynamos and motors. Graphite also aids lubrication and non-fusing.

Unusual structures can be developed by using metal powders. An outstanding example is the self-lubricating bearing, which has a closely controllable degree of porosity within wide limits up to 40 per cent. Another unusual use comprises laminated structures made from flake powders. Bi-metal parts may be formed in this way from layers of different metal powders, the bond between layers being developed in sintering.

Although powder metal parts may be machined, particularly after only partial sintering, parts may be held to close limits so that machining is eliminated and a consequent saving in material and manufacturing costs results. Small spur gears, for instance, can be pressed directly from powders. Saving of raw material is especially important in the case of precious metals.

The various metals used in powder metallurgy may be summarized and grouped roughly as follows: aluminum and aluminum alloys; bismuth, cadmium, columbium, tungsten, tin, zinc, lead; gold, silver, silver alloys; copper, copper alloys (bronzes, brasses, etc.); nickel and nickel alloys (nickel-silver, monel, etc.); cobalt and alloys; iron, steel, and ferrous alloys; molybdenum; and other metals and alloys.

The metal powders are produced by various methods, such as machining, stamping, mechanical disintegration, condensation, chemical and electrolytic precipitation and reduction. Selection of the method is dictated by the nature of the raw materials and the requirements of the finished powders.

After careful selection for suitable grain size and other characteristics, the powders are thoroughly mixed (although this step is not necessary in certain cases). Under extremely high pressure from mechanical or hydraulic presses, the mix is briquetted in closely fitted dies into the desired shape. Pressures run 30,000 pounds to 350 tons per square inch. The shape is then sintered (heat treated) under carefully controlled temperature and atmosphere conditions for a time sufficient to produce the desired bonding and diffusion effect between the particles. With the exception of metals such as lead and tin, metal powders do not flow under the pressures employed, hence every section of the piece must be under direct plunger pressure. Sintering temperature is usually considerably below melting points of the metals.

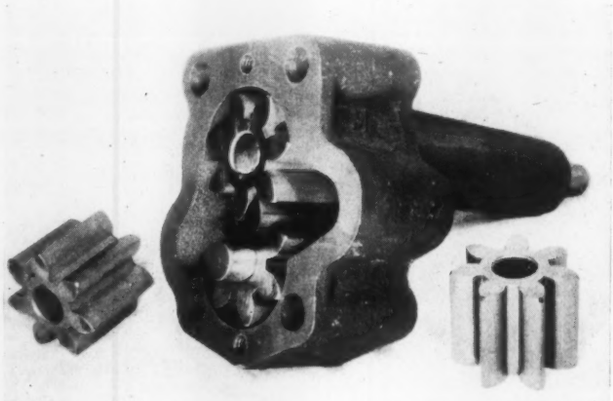
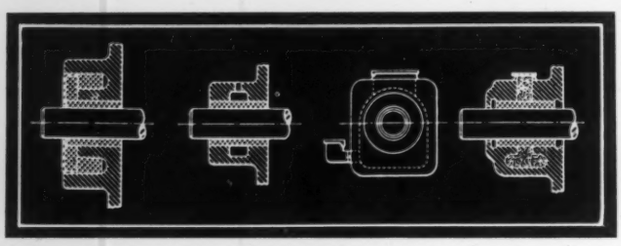


**Fig. 6—Saving of thirty-three per cent in cost is realized in this oil pump gear because no machining is necessary**



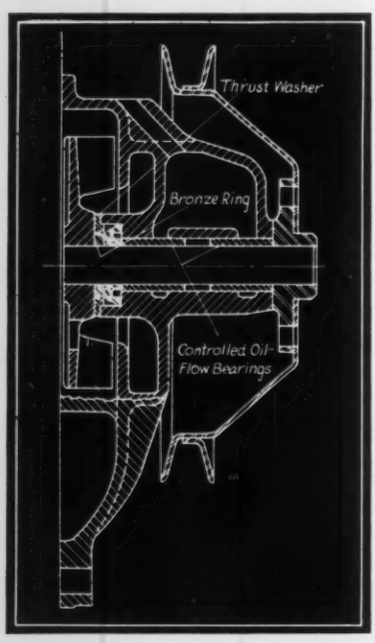



**Fig. 4 — Above — Heavy service may require additional lubrication for porous bearings, in which case an oil well with washer can be used effectively**

**Fig. 5—Left—A good application of oilless bearings. Oil is fed by capillary attraction through the bearing from the cored-in recess**

This process of briquetting and sintering is all based upon the ability of metal particles to adhere to each other when subjected to high pressure. Although the reason for such adhesion is not understood clearly, it has been proved fairly well that heat is a relatively supplementary factor. Before compression the powders are probably covered with a film of oxide or adsorbed gas which hinders adhesion. But this film is ruptured during compression because of mutual abrasion, and clinging then takes place at the points

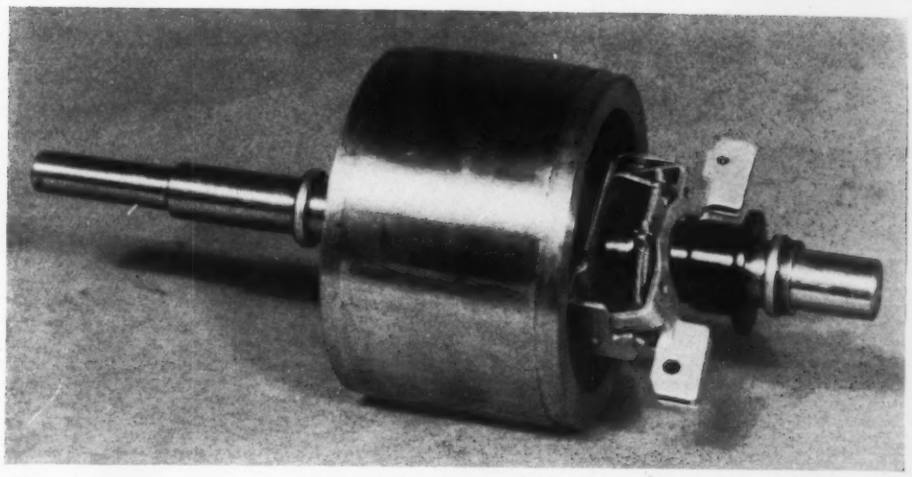


**Fig. 7—Copper powder is utilized for the resistance rings at the ends of this rotor for a squirrel cage motor. Waste of metal is avoided.**

of contact, although perfect and absolute contact is never established. Nevertheless, stronger adhesion will result if greater contact is made, and it is also true that the more plastic is the metal, the better it is able to pull surrounding areas into contact. It is believed by W. D. Jones*, therefore, that "the most important effect of temperature in aiding sintering is only a matter of causing an increase in the plasticity of the metal."

There is virtually no limit to the variety of exterior contours possible with powder metal parts, nor to the contours of vertical holes or indentations so long as there are no undercuts. *Fig.* 1 shows a few representative outlines of such parts. On the other hand, cross holes and transverse indentations must be formed after the piece is sintered, because of the lack of metal flow during compression. Some of these difficulties may be overcome with proper die and press design. *Fig.* 2 illustrates further the number of forms of powder metal parts. These pieces are used in washing machines, automobiles, water pumps, outboard motors, textile machinery, electric motors, oil burners, diesels, pillow blocks, dishwashers and others.

## Oilless Bearings Largest Application

The largest single application at present of powder metal is the so-called oilless bearing, which has such advantages as freedom from lubricating difficulties, accuracy of dimensions, freedom from impurities, low coefficient of friction, quiet performance, and reasonable cost. Typical bearings of this type contain 90 per cent copper, 10 per cent tin, and a small amount of graphite to serve as a die lubricant and to produce a desirable type of porosity. Up to 40 and occasionally even 50 per cent of the volume is impregnated oil which in operation oozes to the surface by capillary attraction. *Fig.* 3 is a photomicrograph magnified 200 times of porous bronze, showing the copper-tin structure and porosity. In cases of continuous heavy service additional lubrication may be recommended. An oil well with a felt washer which touches the outer wall of the bearing may then be supplied, as in

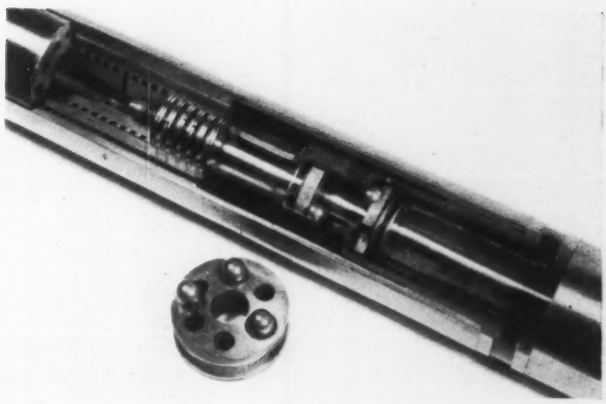


**Fig. 8—Below—Ball and valve seat inserts for this hydraulic oil well pump, hitherto impractical, are made from cemented carbide, to resist dirt and water abrasion**

*Fig.* 4. The second drawing from the left also has an optional oil hole at the top. These bearings have a density of about 6.5, a rockwell C hardness of 70 and a tensile strength of 15,000 pounds per square inch. Increased density increases hardness, of course.

The automotive water pump in *Fig.* 5 is still another illustrative application of these bearings, and is an ideal design example in many ways. There are no oil holes and the oil is fed through the bearing by capillary action from the cored-in recess around it. This design filters all the oil, permitting no dirt to enter, and controls the oil consumption to less than 1 cubic centimeter per thousand miles.

Development of pressed iron as a production material has come within the last five years (compared to approximately 16 for bronze). This iron is typically composed of 98 parts iron and 2 parts graphite, by weight, and like bronze is a porous, smooth-surfaced, strong metal. Its tensile strength is over 20,000 pounds per square inch and its crushing strength is approximately 100,000 pounds per square inch. When impregnated with oil it is corrosion resistant; if plated, it is corrosion proof.

Iron powder parts show unusually low wear under well lubricated conditions, and several small parts

(*Concluded on Page* 83)

* *Principles of Powder Metallurgy*, W. D. Jones, London, 1937.

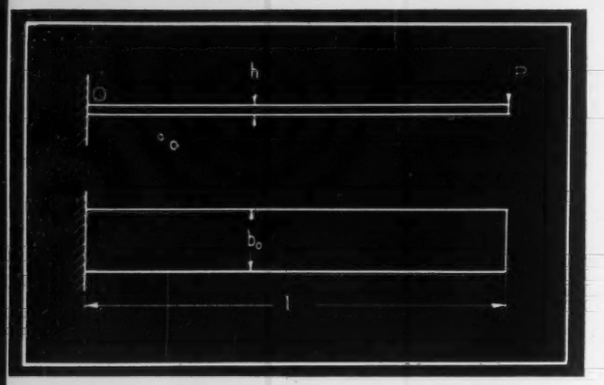



Fig. 1—A simple cantilever spring of rectangular profile loaded at free end

Fig. 2—Curves for calculating deflections of trapezoidal springs

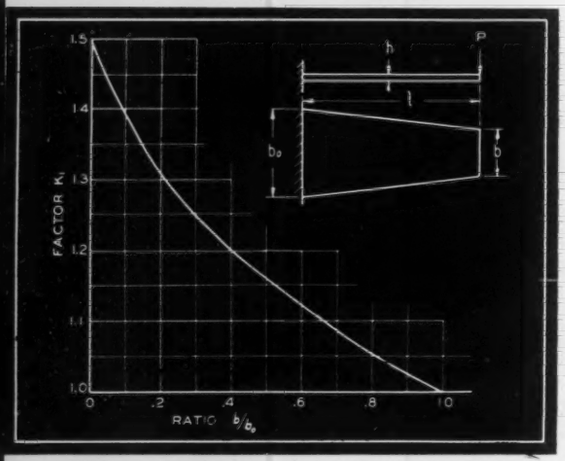
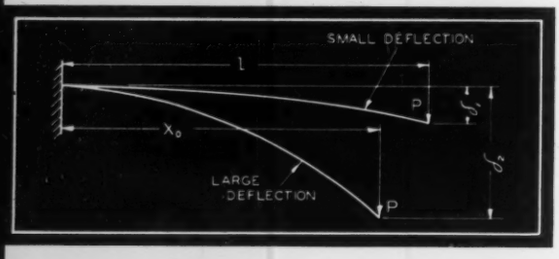



Fig. 3—Cantilever spring with small and large deflections indicating symbol values




# Designing Flat

By A. M. Wahl

*Westinghouse Electric & Mfg. Co.*

WIDER utilization of flat springs is a trend making possible further refinements in machine design. Indicative of the numerous uses of such springs are the unusual applications discussed in the author's article in M. D., November, 1939. This article considers some of the fundamental principles involved in the design of flat springs including plate springs and simple leaf springs. Formulas and charts are presented to facilitate accurate calculations of stress and deflection in a variety of typical cases. The effects of extremely large deflections are considered. Combined axial and lateral loading will be treated in Part II.

Perhaps the simplest form of plate or flat spring is the cantilever spring of rectangular profile and constant cross-section shown in *Fig.* 1. Assuming the spring built in at one end and loaded at the other, the maximum deflection is given by the well-known cantilever formula:

$$\delta = \frac{P l^3}{3 E I} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

where $l$ = length of spring, $E$ = modulus of elasticity of the material and $I$ = moment of inertia of spring cross-section ($I = b_o h^3/12$ where $b_o$ = width of spring, $h$ = thickness).

More exact considerations of the deflection show that if $b_o$ is large compared to $h$ (as for springs of clock spring steel) the deflection will be given by:

$$\delta = \frac{P l^3}{3 E I}(1-\nu^2) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

where $\nu$ = Poisson's ratio. Since for most material $\nu$ is about .3, the deflection given by this equation is approximately 10 per cent less than that given by Equation 1. The reason for this difference lies in the fact that for a spring of relatively great width compared to thickness, lateral expansion or contraction of elements near the surface of the spring is prevented, which results in a slightly stiffer spring than figured from beam theory. In most practical flat spring applications the deflection will probably be closer to the value calculated by Equation 2 than to that calculated by Equation 1.

The nominal stress[1] at the built-in edge $O$ in *Fig.* 1 is given by

$$S = \frac{6 P l}{b_o h^2} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3)$$

It should be noted that these formulas are based on usual beam theory which assumes small deflections. The case where deflections are large is considered below.

In many cases, leaf springs may, for practical purposes of analysis, be considered as cantilever springs of trapezoidal profile as shown in *Fig.* 2. Such a profile makes a more efficient use of the material than does the rectangular profile in *Fig.* 1. For a given load $P$ the maximum stress is again given by Equation 3, where $b_o$ is the width at the built-in end. However, analysis based on ordinary beam theory shows that the deflections are increased over those obtained in the simple cantilever of rectangular profile by an amount depending on the ratio $b/b_o$ between width at the

1. All stresses as calculated herein are nominal values; i.e., stress concentration is neglected. Where variable stress (fatigue loading) are involved they must be multiplied by stress concentration factors which depend on the conditions near the built-in edge. A discussion of this will be given in a later article.

# Springs To Fit the Job

## Part I

free and built-in ends respectively. The analysis shows that in this case the maximum deflection is given by:

$$\delta = K_1 \frac{P l^3}{3 E I_0} \quad \ldots\ldots (4)$$

where

$$K_1 = \frac{3}{(1 - b/b_0)^3} \left\{ \frac{1}{2} - 2\frac{b}{b_0} + \left(\frac{b}{b_0}\right)^2 \left(\frac{3}{2} - \log_e \frac{b}{b_0}\right) \right\}$$

and $I_0$ = moment of inertia at built-in end. The factor $K_1$ depends on $b/b_0$ and may be taken from the curve of *Fig.* 2. It is thus seen that the deflection of a trapezoidal spring is equal to that of a rectangular spring $Pl^3/3El_0$ multiplied by a factor $K_1$ varying from 1 for $b/b_0 = 1$ (rectangular profile) to 1.5 for $b/b_0 = 0$ (triangular profile). Theoretically, the most efficient spring is obtained where $b/b_0 = 0$ since other things being equal, this gives the maximum deflection for a given value of load. Practical considerations, however, usually dictate a value greater than zero. For cases where $b_0$ is very wide compared to $h$ it is necessary to multiply the deflection in Equation 4 by factor $(1 - \nu^2)$ as explained previously.

As mentioned, the beam theory on which Equations 1 to 4 are based, assumes small deflections. In many practical cases, however, the actual deflections cannot be considered small. This is illustrated by *Fig.* 3. When the spring is deflected by an amount $\delta_1$ the ordinary theory will hold. However, when the deflection is increased to say $\delta_2$ it may be seen that the moment arm of the load $x_0$ is considerably less than the length $l$ of the spring. This results in a decrease in both stress and deflection from the values in Equations 3 and 4.

To analyze the case where deflection is large, the more accurate mathematical expression for curvature of the center line of a beam is used. If $x$ is the distance from the built-in end of the beam (*Fig.* 3) and $y$ the deflection at any point, then by equating this curvature to the external bending moment divided by $EI_x$, we have:

$$\frac{\frac{d^2y}{dx^2}}{\left[1 + \left(\frac{dy}{dx}\right)^2\right]^{3/2}} = \frac{P(x_0 - x)}{E I_x} \quad \ldots\ldots (5)$$

where $I_x$ = moment of inertia at distance $x$. Assuming that $I_x = I_0 [1 - (1 - b/b_0)\, x/x_0]$ this expression may be written

$$\frac{\frac{d^2y}{dx^2}}{\left[1 + \left(\frac{dy}{dx}\right)^2\right]^{3/2}} = \frac{P(x_0 - x)}{E I_0 \left[1 - \frac{x}{x_0}\left(1 - \frac{b}{b_0}\right)\right]} \quad \ldots (6)$$

2. See *Die Federn* by Gross, Lehr, and Speer, Springer, 1938 for details of method of integration.

Integration of this equation[2] utilizing the boundary conditions which require that $x$, $y$, and $dy/dx$ = O the reduction in stress and deflection below those calculated from Equations 3 and 4 may be expressed as functions of the dimensionless quantity $c = Pl^2/EI_0$ and the ratio $b/b_0$ between width at end of spring and width at built-in edge. In *Fig.* 4 are given some curves based on Equation 6 for estimating the percentage stress reduction in cantilever springs of trapezoidal profile for various

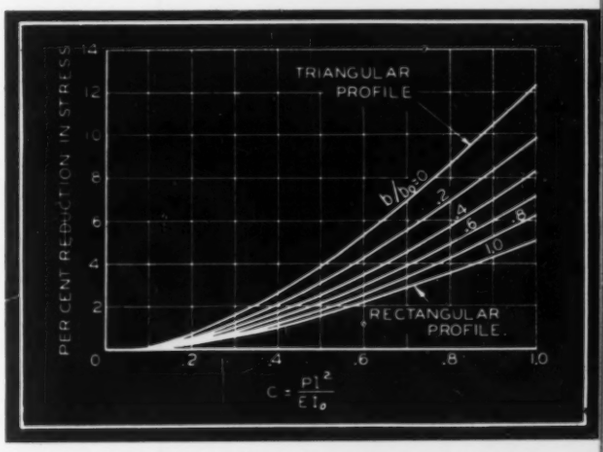
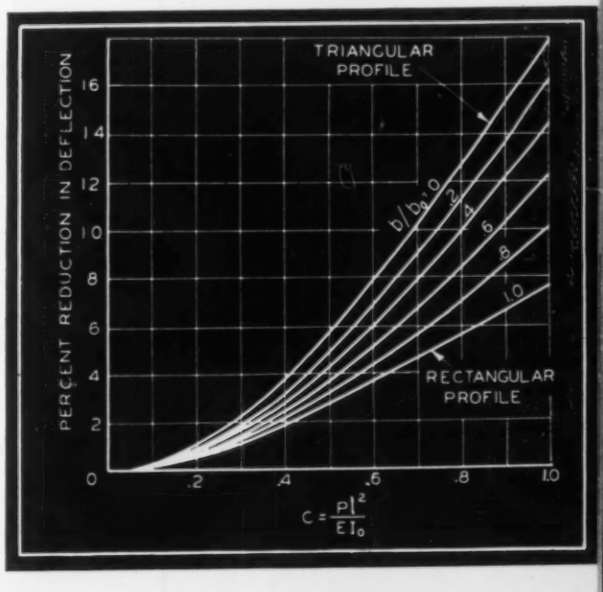



**Fig. 4—Curves for estimating stress reduction due to large deflections of cantilever springs**

**Fig. 5—Curves for calculation of large deflections of cantilever springs**



ratios $b/b_0$ and values of $c$ as compared with the calculated stress value using Equation 3. Where $b/b_0 = 0$ we have a trapezoidal profile and in this case the stress reduction varies from about 0 to 12 per cent for values of $c$ between 0 and 1. For springs of rectangular profile the variation is from 0 to 5 per cent within a range of $c$ from 0 to 1. In *Fig.* 5, curves are also given to estimate the percentage reduction in deflection from the value calculated by using Equation 4. For the range of $c$ from 0 to 1, this correction varies from 0 to 8 per cent for the rectangular profile ($b/b_0 = 1$) and from 0 to 18 per cent for the triangular profile ($b/b_0 = 0$). It is clear that the corrections become larger as $b/b_0$ becomes smaller. While in most practical applications, these corrections may be neglected, for highest accuracy, particularly where $b/b_0$ is small, they should be considered.

### Calculating Stress and Deflection from Curves

As an example, to illustrate the practical utilization of *Figs.* 4 and 5, assume that we have a cantilever spring of trapezoidal profile with the following dimensions (see *Fig.* 2) $l = 30$ inches, $h = \frac{1}{4}$-inch, $b/b_0 = .2$, $b_0 = 6$, $P = 200$ pounds. Assume that the material is steel with $E = 30 \times 10^6$ pounds per square inch. Required, the stress and deflection. For this value of $P$ the quantity $c$ is

$$C = \frac{P\,l^2}{E\,I_0} = .77$$

From Equation 2, the nominal stress is shown by the following:

$$S = \frac{6\,P\,l}{b_0 h^2} = 96{,}000\ lbs.\ per\ sq.\ in.$$

However, from *Fig.* 4, for $c = .77$, $b/b_0 = .2$, there is a 6.5 per cent reduction in stress as a consequence of the large deflection. Thus the actual stress is 96000 (1 — .065) = 89,700 pounds per square inch. From *Fig.* 2 for $b/b_0 = .2$, $K_1 = 1.31$, the deflection becomes from Equation 4:

$$\delta = K_1 \frac{P\,l^2}{3\,E\,I_0} = 10.1\ inches$$

This deflection should be corrected by the percentage given on the curve of *Fig.* 5 for $c = .77$ and $b/b_0 = .2$ which indicates that deflection is overestimated 10½ per cent by Equation 4. Hence, deflection is corrected by a factor (1 — .105) giving a value 10.1 (1 — .105) = 9.05 inches. In addition since in this case the width $b_0$ is very large compared with the thickness ($b_0/t = 24$) a further reduction by multiplying by ($1 - \nu^2$) = .91 should be made as was discussed previously, giving a final deflection value of 9.05 (.91) = 8.25 inches. This is considerably less than the value figured from the simple formula of Equation 4 for maximum deflection.

The subject of this article will be continued in the following issue. In this second part, simple leaf springs and flat springs under combined axial and lateral loading will be discussed. Methods for calculating their stresses and sizes required together with formula and graphs for quickly estimating the proportions needed for applications will be included. In another following article, the author will discuss other forms of leaf springs and the rational determination of working stresses under fatigue loading.

## Eliminates Torque Reaction

IN AIRCRAFT design, torque reaction of the propellers requires compensating features in the fuselage design. However, if two propellers revolve on the same axis but in opposite directions, torque reaction is eliminated. This feature has been incorporated in a design of the French National Engine Manufacturing Co. as discussed recently by *Automotive Industries.* Also, the engine weight has been shifted through remote drive to be placed in the largest cross section of the fuselage to permit better streamlining.

This remote drive comprises an extended shaft carrying a spur pinion at each end, one engaging the

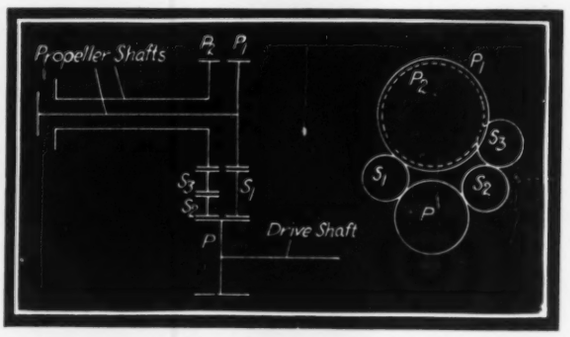
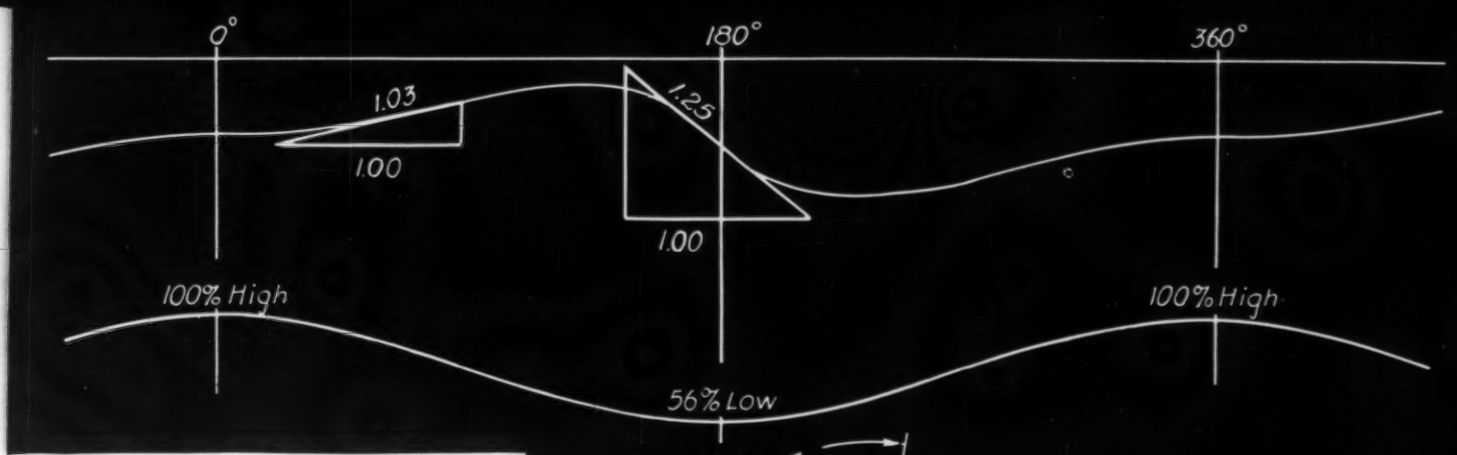



**Diagram of shaft and gear drive to provide rotation of propellers in opposite directions**

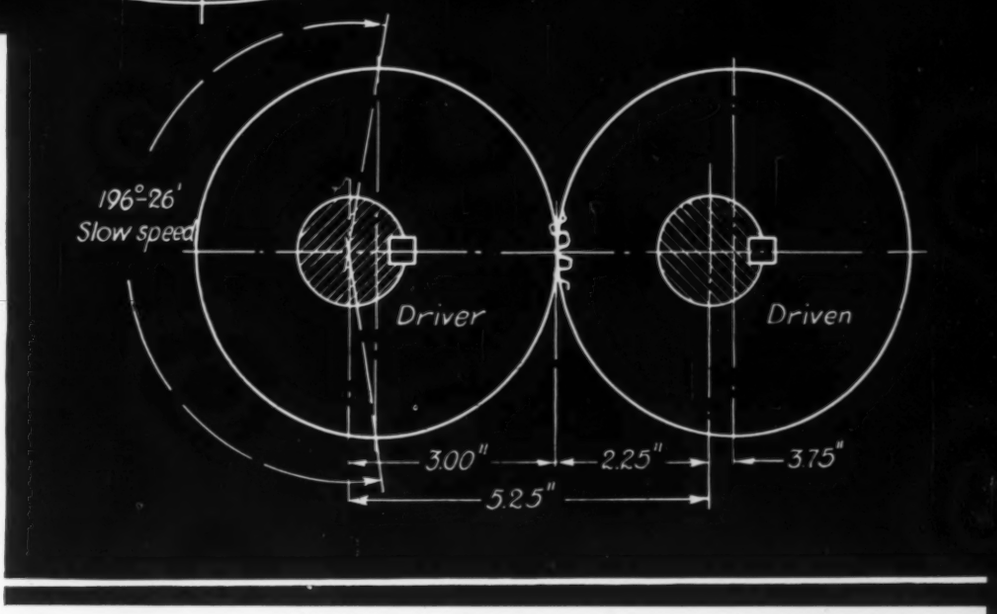
engine crankshaft and the other engaging similarly an internal gear on the primary shaft of a reduction gear box. This primary shaft drives two concentric secondary shafts, one being driven through an intermediary pinion which rotates in the same direction as the crankshaft and the other through two intermediary pinions providing rotation in the opposite direction.

A torsional vibration damper is provided, consisting of a tube secured to the shaft at its forward end and connected to it at its other end through friction disks. The shaft has spherical supports at each end. Drive shaft is enclosed in tubular housing with spherical supports on engine and reduction-gear housings, respectively.

Whether turbulence of air and propeller inefficiencies would offset the advantages gained, tests on this unusual design will disclose. These advantages will also have to offset higher costs, additional weight and increased maintenance.




Design of elliptical gears to permit variable feed. Top curve is cam velocity. Bottom curve shows how elliptical gears control feed to match cam profile




# Elliptical Gears Provide Feed Control

By W. W. Boyd

OF ALL ingenious mechanisms employed to simulate the movements of the human hands, cams are outstanding. Their ability to accomplish complex motions is due to their capacity for translating regular movement into irregular or intermittent motion, sometimes with periods of rest or dwells.

Manufacture of cams however, is often a real problem, especially when produced in large quantities and with close fidelity of profile. Large cams present few difficulties but small ones quickly multiply errors and may become noisy when operating at high speeds.

In making drum or cylinder cams, if the circumferential speed of the cylinder is maintained constant while the track is being milled, deviations from the straight path cause increased feeding velocities which are difficult to correct. This increase in the resultant velocity of feed produces a scalloped effect because the movement of the cylinder is so rapid that when the next cutting edge of milling tool contacts the metal it gouges out a space and moves along for the next cutting edge to do the same.

To correct this difficulty of feeding, especially when a single purpose machine is to be used, a simple method utilizes a pair of elliptical gears proportioned in such a way that the high speed of the feed will correspond to the part where the cam surface speed is slowest and the slow speed of the elliptical gears will occur at the portion of the cam profile where the resultant speed of rotation would normally be at its highest.

In the illustration a cam path presents the problem of a steep ascent within a very short period of

time, but the rest of the curve is more uniform. For the gradual rise, the circumferential feed can be comparatively rapid, but the resultant feeding velocity at the steep part of the curve will cause a rough profile.

In this instance, the gradually rising portion of the curve has a resultant velocity very close to the circumferential velocity, but the sharp part of the curve shows a decided increase. The resultant velocity is 1.25 times the circumferential velocity as shown by the tangent to the curve at this point. Thus, the circumferential velocity should be reduced to 80 per cent to produce a smooth profile by removing the metal in finer chips. This can be accomplished without increasing the cutting speed.

Such a ratio presents a means for proportioning the major and minor axes of the ellipse. The center distance between the elliptical gears is determined by the shaft diameters and the minimum thickness of metal between the bottom of the teeth and the circumference of the shaft.

For the purpose of this discussion, we may assume a center distance of 5.25 inches, and, for this reduction ratio, the focal distance becomes .375 inches; the minor axis is 5.196 inches; then the gear ratio varies from $2.25 \div 3 = .75$ for the slow speed to $3 \div 2.25 = 1.33$ for the high speed; or using the high speed as 100 per cent, the slow speed is 56.25 per cent of the high speed. Considering the constant speed of the driving shaft as 100 per cent, the high speed of the cam shaft is 133 per cent and the slow speed is 75 per cent.

Now, knowing the major and minor axes, the true perimeter of the ellipse may be found from the following series.

$$S=\pi(a+b)\left[1+\frac{1}{4}\left(\frac{a-b}{a+b}\right)^2+\frac{1}{64}\left(\frac{a-b}{a+b}\right)^4+\frac{1}{256}\left(\frac{a-b}{a+b}\right)^6+\ldots\right]$$

in which $a$ is the semi-major axis and $b$ is the semi-minor axis. A close approximation is

$$S=\pi\left(\frac{a+b}{4}\right)\left[3(1+\lambda)+\frac{1}{1-\lambda}\right]$$

where

$$\lambda=\left[\frac{a-b}{2(a+b)}\right]^2$$

For the values chosen, the true perimeter is 16.4085 inches. Using a diametral pitch of 14, 73 teeth are obtained, which is desirable because the tooth of one gear will register with the tooth space of the mating wheel on the common major axis center line of the gears, and both gears may be cut at the same time. With this large number of teeth, we may expect three teeth always to be in contact; this will produce smooth progression, without chatter, and, by presenting sc many bearing surfaces, prolong the life of the gear pair.

By using the semi-major axis and the eccentricity, the period of duration of high speed is 163° 34′ and the low speed period 196° 26′ with reference to the rotation of the constant speed driving shaft.

Development of the curve for the speed ratio for the elliptical gear pair shows that the path is smooth and regular. By placing this graph above that of the cam path, it is noted that, when the curves are in correct angular position, the feeding speed of rotation decreases gradually as the slope of the cam path increases, then the feeding speed increases as the path straightens out.

By such an arrangement, a positive, dependable feed drive is assured from which consistent results may be obtained. Elliptical gears have wide application where feeding must occur during a small angular period of power shaft rotation. They are not costly, especially when compared to other speed change devices.

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## Chain Drives Show Change of Pace

SEVENTEEN teeth has for many years been considered a desirable minimum number of teeth for chain drive pinions in this country. Given a certain specified motor speed, the aim of a machine designer or the engineer of a chain drive company would be to select a chain of such a pitch (varying, say, from ⅜-inch to 1½-inch) that a chain speed of around 1500 feet per minute would result, with the 17-tooth motor pinion. Satisfactory, compact drives were obtained by this method, both roller chain and silent chain being utilized. Either multistrand roller chains, rather than single strand, or wide silent chains were employed for transmission of extra heavy loads.

More or less revolutionary developments that recently have been made by engineers of the Morse Chain Co. indicate that the time-honored 17 teeth and 1500 feet per minute may be retained only on drives where ratios are high, where extreme compactness is essential or where maintenance is likely to be mediocre. In the new type of drive, pinions having large numbers of teeth are employed and advantage is taken of the higher chain speeds for transmission of power. A pinion of 59 teeth is being utilized in one instance and on this particular drive the chain speed actually is 5600 feet per minute. But at this speed only 1-inch width of silent chain is needed to transmit 50 horsepower, and multiples of this—up to any reasonable width—can be used.

It is said that the particular drive mentioned has been running two years without adjustment. The drive is enclosed in an oiltight case and is equipped with a small oil pump to throw a continuous jet of oil on the chain. No difficulty of any kind has been experienced and it would be hard to find a more sweet-running positive type of machine drive.

Fig. 1—Fuselage members are almost entirely of tubing in this speedy attack plane

# Strength-Weight Ratio Is Improved by Steel Tubing

By John W. Greve

TUBULAR members are being used more extensively in structural machine design both because of adaptability to modern fabrication methods and relatively high strength-weight ratios. For portable machines where light weight and rigidity are essential; for load-carrying machines where increased pay loads and reduced cost of operation are required; for transportation equipment where a combination of the qualities inherent in tubular members is desirable—tubing furnishes the designer a readily available and adaptable solution to many of his problems.

In airplane design these features are especially necessary and are indicative of the extent to which tubing may be utilized. In *Fig.* 1 is shown a frame of an attack plane in which the fuselage structure is designed to withstand critical loadings under various flight and landing attitudes of the airplane. The design is consistent with the maximum strength and minimum weight requirements; however, multiplicity of tube sizes has been avoided. The fuselage frame assembly consists of an engine mount structure, a forward section, and an aft section all of which are of welded chrome-molybdenum, SAE 4130, steel tubing and fitting construction, except the lower rear portion of the aft section which is of aluminum alloy semi-monocoque construction.

The engine mount and forward and rear sections of the fuselage are bolted together through fittings which are welded into the tubing structure as shown in *Fig.* 2. Plates welded to the lower ends of the tubes of the aft section provide means for attaching the semi-monocoque bottom structure. Fittings and tubes are welded into the structure as required to provide a means of attaching the wing, empennage, instruments panels, seats, firewall, and miscellaneous parts and items of equipment. A steel tubing structure projecting above the fuselage proper is an integral part of the fuselage frame assembly and forms an overturning structure

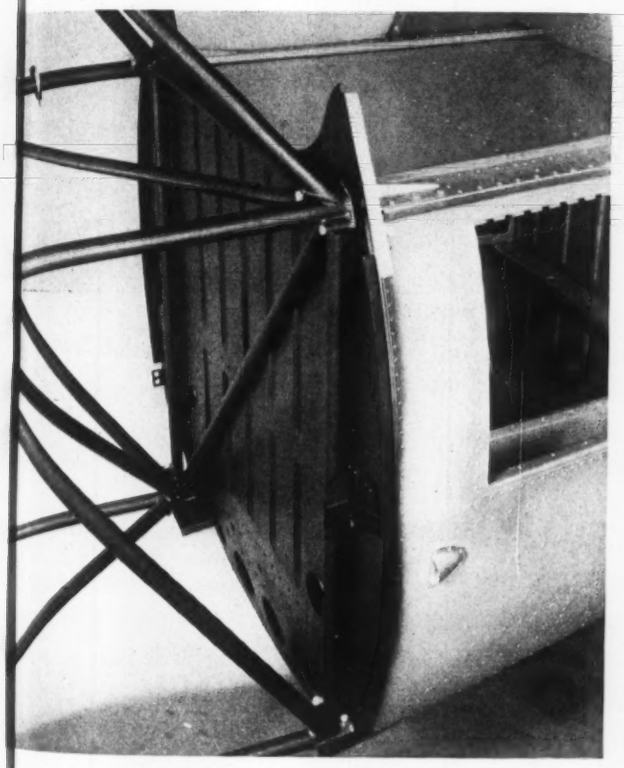
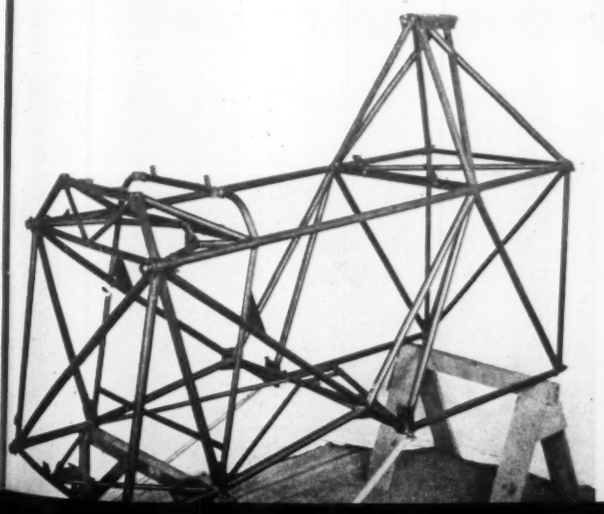


Fig. 2—Above—Fuselage sections are joined by bolting through welded-in provisions at joints. Fig. 3—Forward section of cockpit has extension for protecting pilot



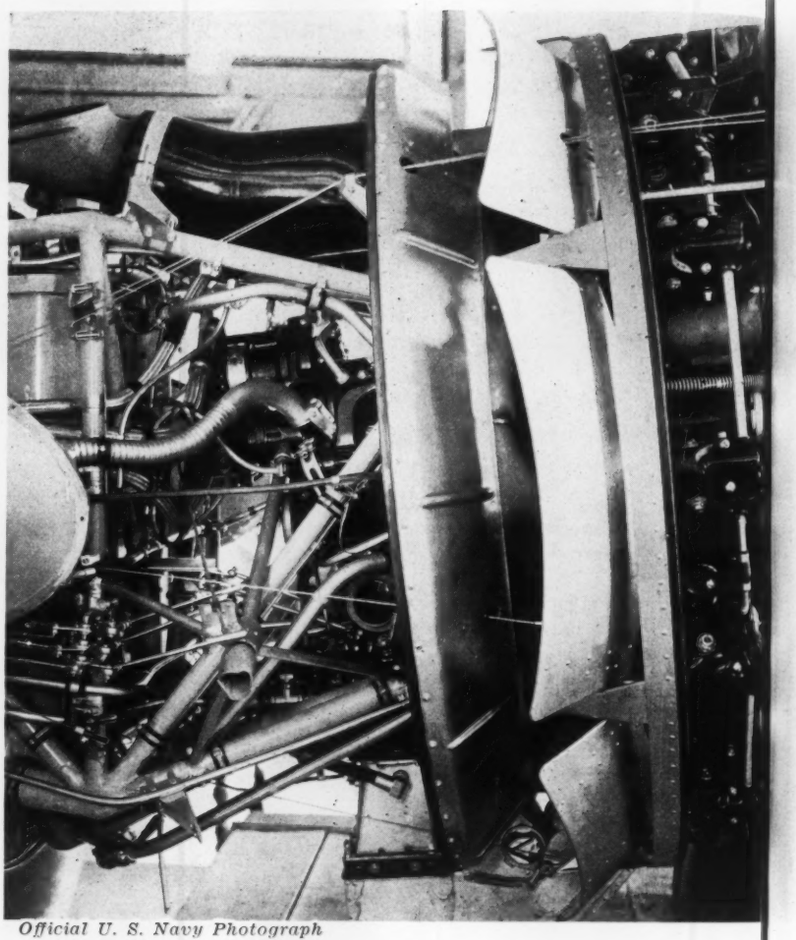
for protection of the occupants of the airplane. This structure is seen in the section of cockpit, *Fig.* 3.

Other parts are readily secured to this skeleton fuselage frame assembly by means of standard clamps and special brackets. Simplicity, accessibility, repairability, exchangeability, are features of this design. It is to be noted that attachment points, readily detachable side panels, removable cowling, and other advantageous factors facilitate the accomplishment of periodic inspection and maintenance requirements, and provide for easy repair and quick replacement.

Stainless steels because of their high corrosion resistance and high strength are being used extensively, the most used type being the well known 18-8 chromium-nickel alloy. This material is used economically where high tensile strengths are desired. Strengths of 180,000 pounds per square inch and above with 8 to 10 per cent elongation are generally used.

Stainless steels may be divided into two categories, heat resisting and structural, some of which are heat treated to increase their strength. Their high resistance facilitates spot welding. They remain soft after welding and treating operations. Being stabilized the 18-8 type is not subject to carbide precipitation. Present trends toward housing engines in the fuselage require high heat resisting qualities. *Fig.* 4 shows an engine mounted in fuselage of tubular construction.

Choice between use of steels and aluminum alloys such as super-duralumin, "24-ST," containing copper, magnesium and manganese rests with the design,



*Official U. S. Navy Photograph*

**Fig. 4 — Above — Engine is mounted in fuselage of tubular steel construction**

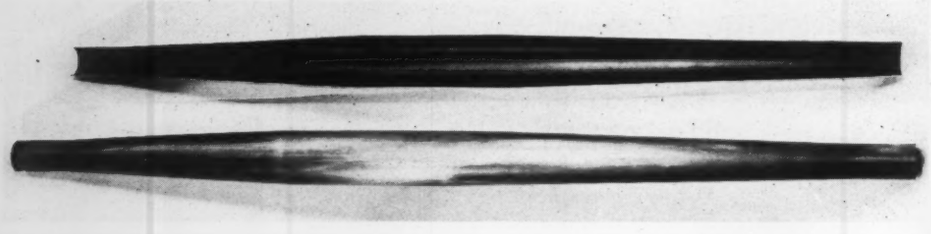


**Fig. 5—Steel tube is tapered at both ends. Wall thickness of cutaway shows control**

type of service and construction methods. Stainless in itself is corrosion resistant, aluminum alloys require coatings. Steels are readily fabricated by welding methods; aluminum being more difficult, rivets are used instead. Generally speaking stainless is 3.5 times as strong as aluminum but 2.8 times as heavy. For long column compression members the aluminum alloy has some advantages. On the other hand for tension members and members subjected to repeated stresses, stainless has advantages.

Everything that increases the strength of fuselage members and at the same time reduces their weight is desirable. Tapering tubes with a double taper, i.e., tapering from a base size tube to both ends, gives a member increased strength per unit weight against bending. Thus savings of 15 per cent and possibly 25 per cent can be effected on many important parts. Single taper tubes also have wide application.

In addition to savings in weight of the tubular member, there are corresponding savings in assembly costs and weight of fittings, connections and especially faring for parts in the air stream. Examination of *Fig.* 5 showing a double-taper tube and a section through a similar tube shows how in a large tube, the wall thickness has been maintained uniformly.

How extensively tapered tubes may be used in aircraft is not known although applications are now being made to landing gear tubes, fuselage parts, engine mount legs, and torque tubes. Wall thickness of the taper can be made heavier or thinner at each end, or held uniform throughout the whole length.

The co-operation of the following companies is gratefully acknowledged in the preparation of this article: Carnegie Illinois Steel Corp., Consolidated Aircraft Corp. (*Fig.* 4), Fairchild Aircraft Corp., Fleetwing Inc., Glenn L. Martin Co., National Tube Co., North American Aviation Inc. (*Figs.* 1, 2 and 3), and Summerill Tubing Co. (*Fig.* 5)

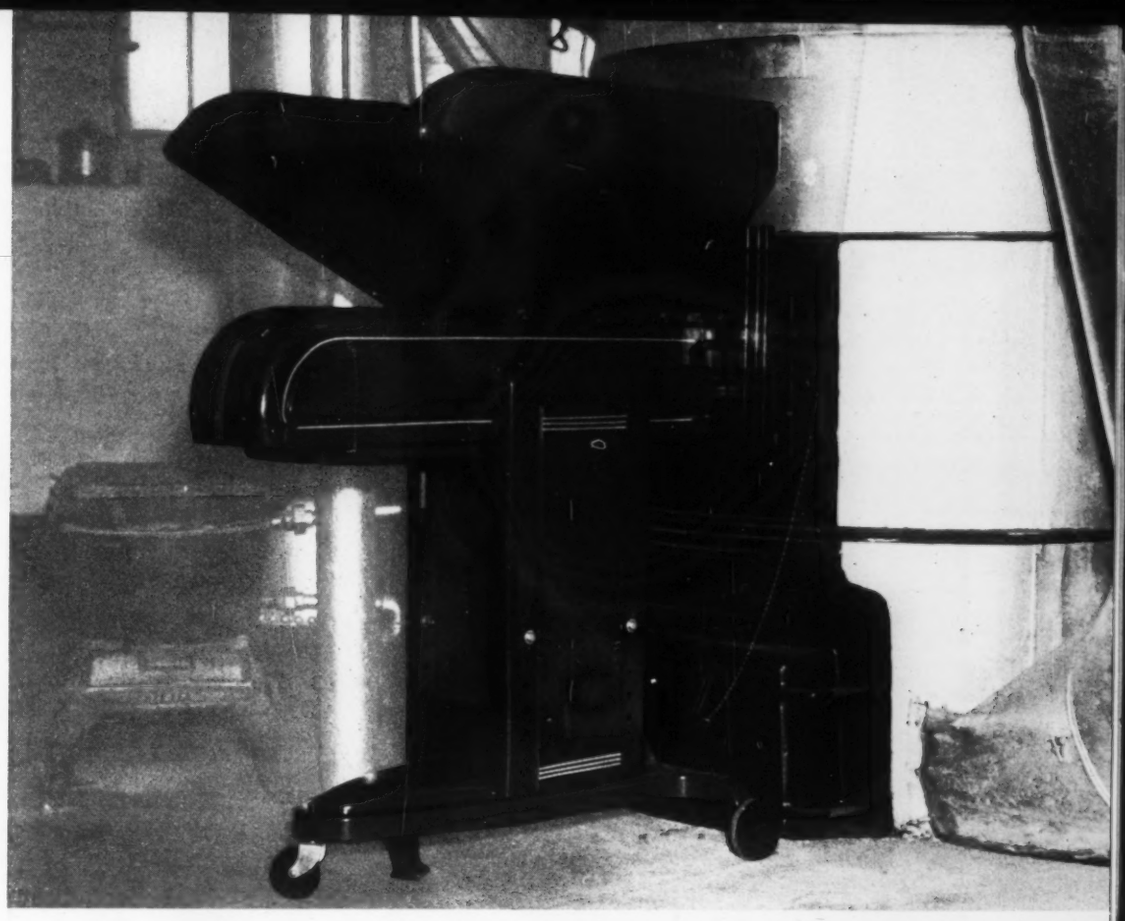
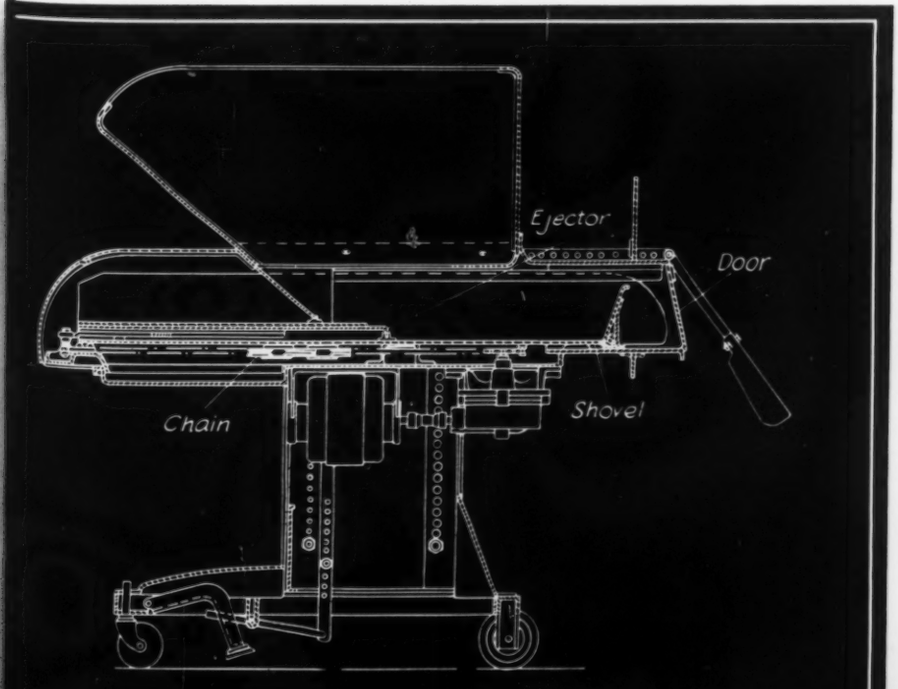


Fig. 1 — Right — Light weight and low cost feature this pusher type stoker. Fig. 2— Below — Cross section illustrates operating features of unit

By
A. H. Allen

# Stamped Metal Parts—

## How Applied in Designing Low-Cost, Ejection Stoker To Utilize Production Facilities of Manufacturer




LOW cost and light weight were two primary factors bearing on the design of the domestic stoker shown in *Fig.* 1. Novel in that it employs an injector-type coal feed instead of the conventional screw feed, this unit is designed to utilize the existing facilities of a plant primarily engaged in the production of stampings for the automotive industry.

Capable of handling efficiently hard coal, soft coal or coke, this stoker is adaptable to heating plants without requiring changes in the furnace. The principle of operation involves the use of a control arm, *Fig.* 2, resting on the fuel bed. By its position, up or down, the arm regulates the supply of fuel to the bed by actuating a mercury

control switch for the stoker mechanism.

This stoker, developed by the Murray Corp. of America, Detroit, involves a base of sheet steel, die formed from flat stock, split and butt welded into wishbone shape. Cross piece at the front is formed in a press into a U-channel and spot and arc welded to the base. The base cover is steel, flanged and spot welded to the frame. Vertical supporting members are a back panel, front panel and stanchions on each side, the upper stanchion sliding over the lower for

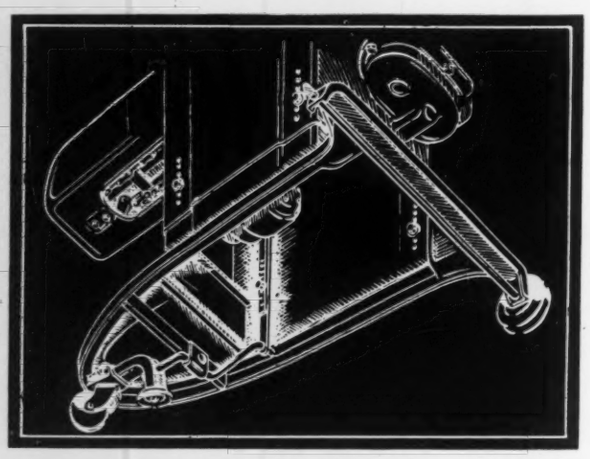


**Fig. 3—Wishbone construction of base and height adjustments are shown in this bottom view**

adjustment for furnace height. This base construction is shown in *Fig.* 3.

Main horizontal members of the stoker include an outer casing, of sheet steel, at the front of which is bolted a stoker extension, also of sheet steel. At the rear is a curved cover plate concealing the inner parts.

The operating mechanism is a series of telescoping troughs traveling over risers welded to the base panel. The injector trough rides between upper and lower shovel troughs with an ejector which moves out to the end of the injector travel. The ejector is on the bottom of the lower shovel element and carries at its front a loosely mounted curved casting to act as a pusher. Being curved and loosely mounted it is not subject to jamming.

When in operation the shovel portion of the unit extends to the preset limit of its travel followed by the ejector which acts as a pusher to force a charge of fuel over the end of the shovel into the center of the firepot. Dust seals and dust shields of pressed steel are spotted at points where coal dust might otherwise leak through on the mechanism or floor.

The cycle of extending and retracting the injector and shovel elements requires about 1.75 minutes and approximately 500 cycles are made per ton of fuel handled. Stops are provided to vary the length of extension to suit different size firepots, six settings shown in *Fig.* 4 being available. Mounted on the stoker extension is a furnace plate of 3/16-inch steel, grooved so that the edges can be trimmed to permit an exact fit, sealing the furnace door opening. It is located on the extension in any one of a number of positions along the upper edges.

The control arm, a rolled steel section capped at the end by a U-section gray iron casting, is bolted to the end of the stoker extension. Through a link which connects with a steel arm the mercury control switch is actuated. A small, hinged steel door closes the end of the extension except when the shovel is discharging a load of fuel. Among other things, this door prevents any flashback in the injector after a charge of fuel has been deposited in the furnace, the door swinging closed from its own weight.

Driving motor, 1/6-horsepower, is a split phase, drip-proof open type and is mounted in rubber rings carried in a bracket inside the leg of the stoker. It is connected to the gear unit through a rubber flexible coupling. From the gearbox, ahead of the stoker leg, a vertical shaft carries a sprocket on which rides a hardened steel chain, ⅜-inch wide and 1¼-inch pitch. At the rear end this chain passes over a hardened steel disk 2 inches in diameter, sprocket and disk spaced on 32-inch centers. A carrier link on the chain connects to the injector and as it passes up and down the length of the chain travel moves the injector and shovel through their cycle.

The motor has a built-in automatic reset overload device protecting it from burnouts in the event of inadvertent jamming of the mechanism. All wire connections are bolted to terminals fully enclosed in a junction box integral with the motor end bell. Wires from the mercury switch tube are enclosed in a conduit of double-wrapped, moisture proof silk

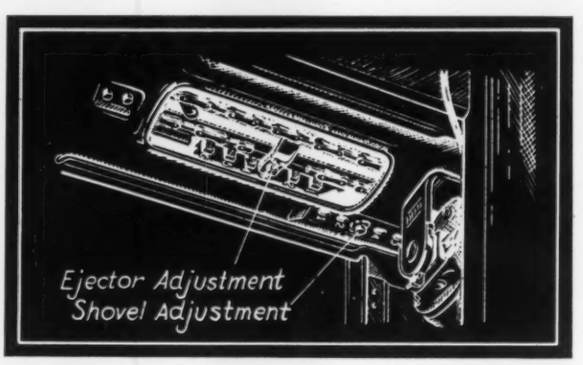



**Fig. 4—Adjustments are provided to control fuel delivery according to requirements**

and cotton. Where the wires are exposed at the switch end they are covered with 1/32-inch rubber sleeves, and a rubber grommet covers the end of the conduit where the wires emerge.

Portability has been achieved by holding down weight to 200 pounds, mounting the equipment on three hard rubber wheels and confining dimensions to 40¾ inches high, 44½ inches long and 26¼ inches wide.

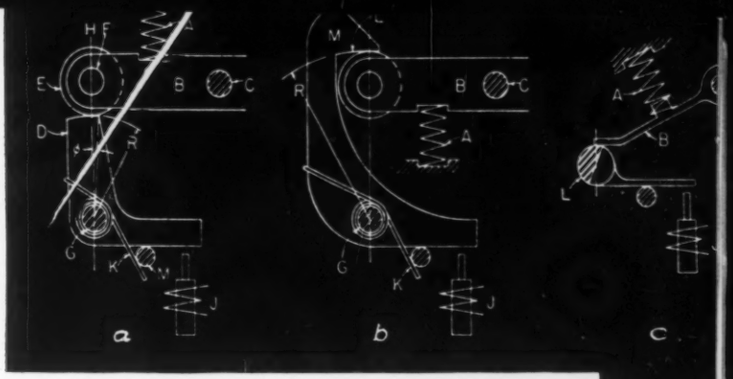



Fig. 1—Dead-center latches of Class 1 type. At (a) is shown a prop-roller latch, (b) a hook-roller latch, and (c) a sliding latch

# Design Characteristics of Release Latches*

By Carl Thumim
*General Electric Co.*

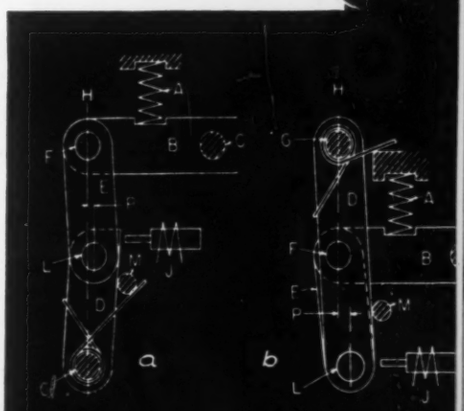



Fig. 2—Right—Overcenter toggle latches, Class 2 type. Compression-toggle latch is at (a) and tension-toggle latch at (b)

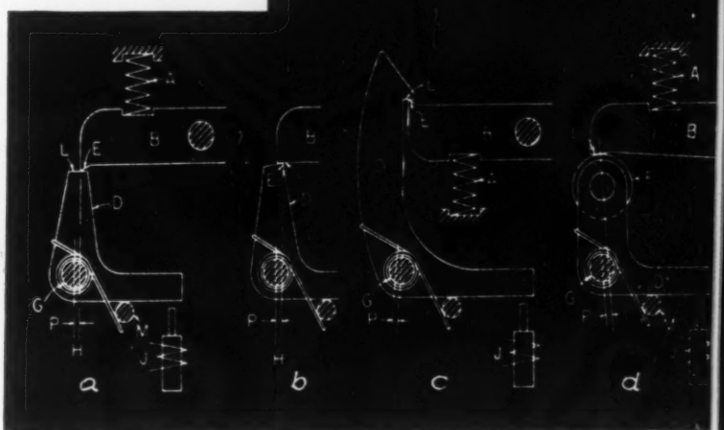
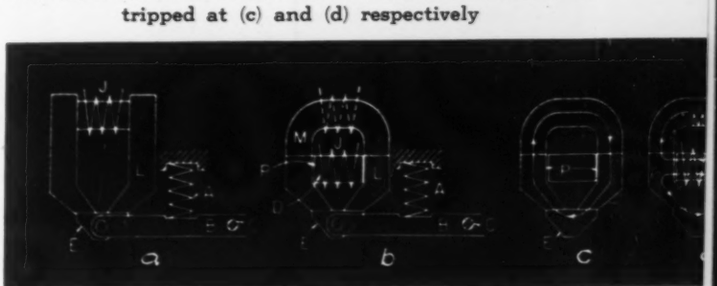



Fig. 3—Above—Overcenter surface latches of Class 3 type. At (a) and (b) are shown prop type latches while (c) is a hook type and (d) is a roller type latch

Fig. 4—Below—Class 4 magnetic latches. A simple magnetic latch is shown at (a) and a flux-shifting latch at (b). Flux lines for the latter are shown with latch closed and tripped at (c) and (d) respectively




MECHANISMS that depend upon release latches for their operation require latch designs in accordance with the degree of reliability and speed of operation necessary. Too little attention has been paid to rational considerations in the design, manufacture and maintenance of a device so vital to proper operation of equipment. Circuit breakers provide a good example of mechanisms in which dependable, quick acting release latches are essential.

Latches may be defined as mechanical devices which hold securely under any set of predetermined conditions, and release with equal reliability under another set of circumstances. All latches can generally be divided into four classes:

Class 1—dead center
Class 2—overcenter toggle
Class 3—overcenter surface
Class 4—Magnet

Class 1 latches have several subclasses as illustrated in *Fig.* 1. The best is shown at (a) where torque caused by the force of a spring acting against a pivoted lever is resisted by support of a prop. As the two co-acting surfaces are perfectly circular with their respective pivot points, the line of force goes through the point of tangency and through the exact centers of these points. There is, therefore, no moment to cause rotation around $F$ or $G$ and the latch is in stable equilibrium. To trip, a coil is energized and its plunger

* From a paper presented before the annual meeting of the American Society of Mechanical Engineers at Philadelphia, Pa.

strikes the prop and removes the obstruction to the rotation of the lever. After resetting, spring *K* returns the prop to its locking position.

*Fig.* 1(b) shows the same principle with a hook taking the place of a prop. While the method of action is identical the true radial surface is more difficult to obtain. A simplified version is illustrated in *Fig.* 1 (c), which can be used where the forces are small. The prop consists of a shaft with the middle section cut away to permit the lever to trip.

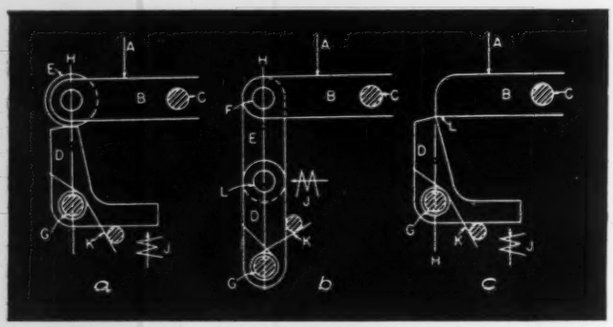


**Fig. 5—Above—Latches under ideal condition with neither friction nor locking torque forces. Class 1, 2 and 3 latches are shown at (a), (b) and (c) respectively**

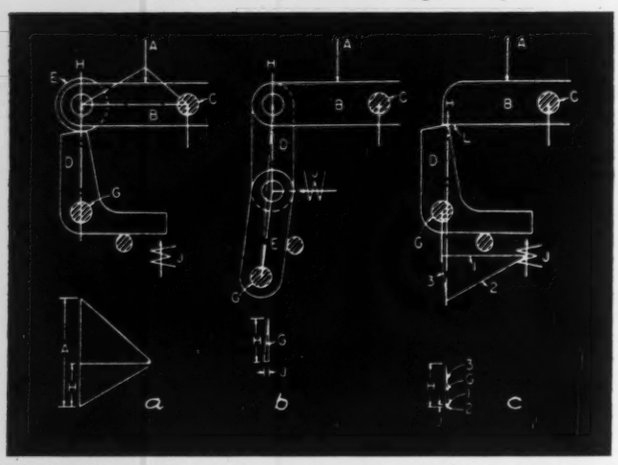
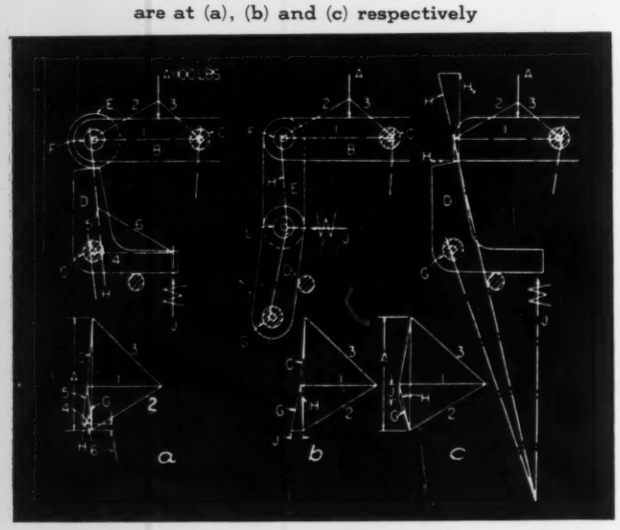


**Fig. 6—Above—Latch comparison for equal trip distance with zero coefficient of friction. Class 1, 2 and 3 latches are shown at (a), (b) and (c) with their vector diagrams**

**Fig. 7—Below—Latch comparison under normal conditions with 25 per cent friction. Vector diagrams are shown with each class of latch. Class 1, 2 and 3 latches are at (a), (b) and (c) respectively**



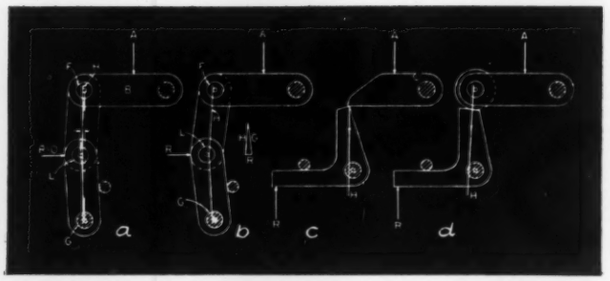


**Fig. 8—Force reducing linkages. Class 2 latches are (a) toggle on friction dead center and (b) toggle with effective reduction. Class 3 latches are (c) sliding and (d) roller**

These latches are called dead-center types because the restrained force of the spring has no resulting moment which would cause the latch to rotate—a lack of effect typical of any dead-center mechanical construction. Ordinarily, the dead-center position is a point or a narrow band having a zero moment on each side of which there is an effective turning moment. In the Class 1 design, this band can be made as wide as desired. For example, in *Fig.* 1(a) the dead-center action persists for the rotation of the prop through the angle $\phi$. There is no tendency for the lever to move until the end of the latch surface has passed the center line *H*.

## Overcenter Latches Have Locking Force

Latches of the second class consist of overcenter toggles, illustrated in *Fig.* 2. Two schemes are generally used, compression or tension, as shown by (a) and (b). In (a), the spring tends to turn its lever counterclockwise around a pivot. This movement is restrained by toggle links locked against a stop. The nominal amount of overcenter is indicated by *P*. To trip, the coil is energized and drives the toggle over center. The toggle then collapses and removes opposition to the motion of *B*. During this action, i.e., until pin *L* reaches center line *H*, *B* is rotated clockwise, and the trip coil is used to compress the spring. To reset, *B* is pulled into stretched-toggle position by a part of the mechanism not shown and the toggle is driven to the locked position by spring *K*. Action in *Fig.* 2(b) is the same as that in (a) except that link *D* is in tension.

The third classification of latches consists of the overcenter surface type and depends for latching characteristics on the configuration of a surface. It is used more than any of the other types, especially in other than the electric apparatus field, probably because it may be adjusted to give "hair-trigger" action. In *Fig.* 3 are illustrated three common forms of this class. In *Fig.* 3(a) the force of the spring on its lever is resisted by a prop. The slope of surface *L* determines

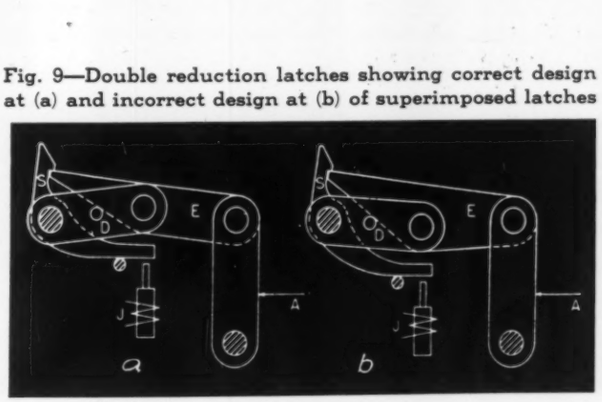
the direction of the force $H$. The distance $P$, is the moment arm which, with the force $H$, provides the moment to hold the latch locked against the stop. The greater this moment arm the greater the locking torque and therefore the greater the force required to unlock the latch. This distance may be reduced to the point where only a slight force is needed to trip and hair-trigger action results. With such accurate adjustment, it requires very little motion from vibration or shock, to unlatch. Likewise, wear may eliminate the locking effect entirely.

The latch in *Fig.* 3(b) is identical with that of (a), except that surface $L$ is part of lever $B$. In *Fig* 3(c) is illustrated another common latch of the hook type, in principle the same as (a). Variant in (d) is (b) with a roller replacing the sliding point. This latch reduces tripping force, requires more motion of the trigger to release, and is different from the one in *Fig.* 1(a), in that it depends on a locking torque arm, whereas the (a) latch needs no locking torque.

## Magnetic Latches Are Quick Acting

Magnetic force is the locking characteristic in the fourth class of latches. The usage as a latch, shown in *Fig.* 4, is limited but is employed more to provide tripping force in conjunction with one of the other mechanical latches, where extreme speed gives it an advantage. At (a) is shown the simplest type of magnetic latch. The force of the spring on its lever is resisted by the pull of an electromagnet on an armature. To maintain the force on the armature, the coil must be continuously energized. To trip, the circuit is broken, releasing the armature. The time of tripping can be reduced to a minimum by the "flux-shifting" type in *Fig.* 4(b). An electromagnet is proportioned to supply the maximum attracting force to the armature. A trip coil is placed between the pole pieces with definite gaps. When latched, the flux circuit is shown at (c), the reluctance of the iron being so much less than that of the air gaps that practically all the flux lines go through the armature. When the trip coil is energized, *Fig.* 4(d), the reluctance of the air gaps is reduced so that the flux passes through the trip-coil core and the flux through the armature is reversed, thus causing the armature to move away as soon as the holding

**Fig. 9—Double reduction latches showing correct design at (a) and incorrect design at (b) of superimposed latches**



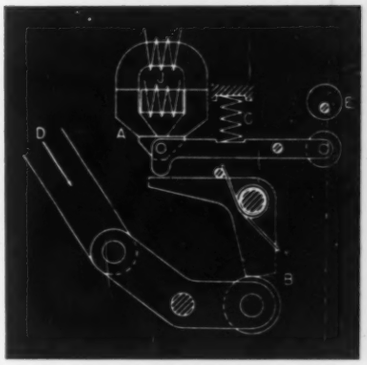




**Fig. 10—Class 4 latch used to supply tripping force. Cam device at E is used to reset latch after tripping**

torque becomes smaller than the load torque. With proper proportioning, appreciable movement can be obtained in .001 second.

To obtain a more comprehensive picture of the characteristics of the first three latch classes, force analyses of typical designs under various conditions are presented. The quality of a latch is often indicated by its behavior under ideal conditions which may be interpreted to mean friction coefficients and locking torques equal to zero. *Fig.* 5 shows the three classes of latches under these circumstances. Since (a) is a Class 1 latch, the locking torque is inherently zero. The Class 2 latch of (b) must be placed on dead center to eliminate locking torque. In the Class 3 latch at

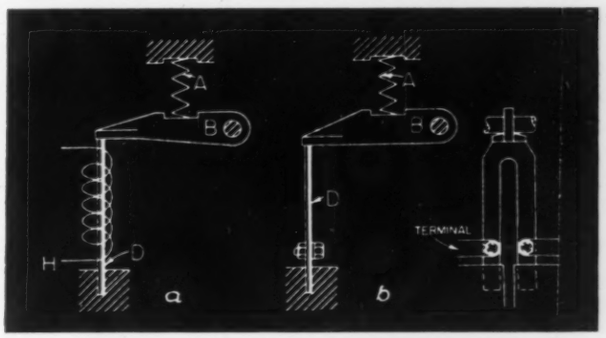
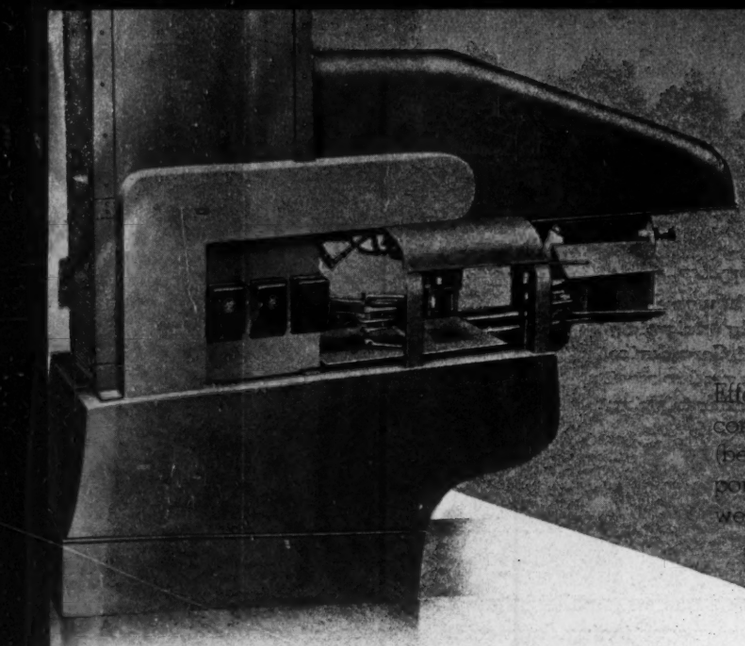



**Fig. 11—Thermal trip used in conjunction with Class 3 latch with heating coil at (a) and resistance of bimetal at (b) for operation of latch**

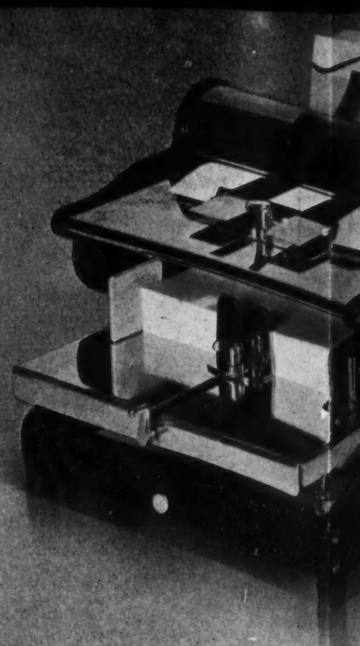
(c), the surface $L$ must be so directed that $H$ goes through the center of pin $G$. Under these circumstances and with zero friction, the tripping forces are zero. The torque of restoring spring $G$, small in proportion to the other forces, has been neglected. Of the three latches, only (a) is in stable equilibrium, a large motion of $D$ having no effect, while slight changes in the other two would either unlock them or lock them with a torque of unknown magnitude.

Since, under the circumstances described, two of the three latches are unstable, an analysis is now made of their behavior when all are positively locked, with the same amount of motion to unlatch. This

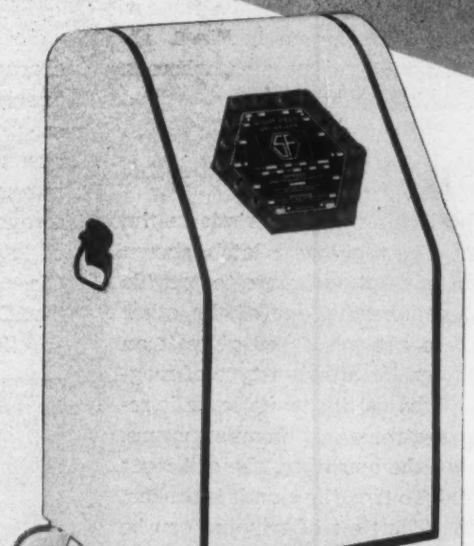
(*Continued on Page* 87)



Effective use of color and of "cleanlined" contours make the Sight Feed arc welder (below) unusually attractive. Finish is white porcelain with red stripe, and cabinet is welded steel. Without moving parts, the welder's coils are wound for aircooling



A centralized camshaft controls all operations on containers in the welded Packomatic Commander (above), being driven by a roller chain and sprocket. Primary drive is from motor to gear reducer. Many parts in movable assemblies are aluminum castings for light weight. Completely automatic except for container replenishment, the machine has electrical safety devices which stop it if containers are misplaced in any way



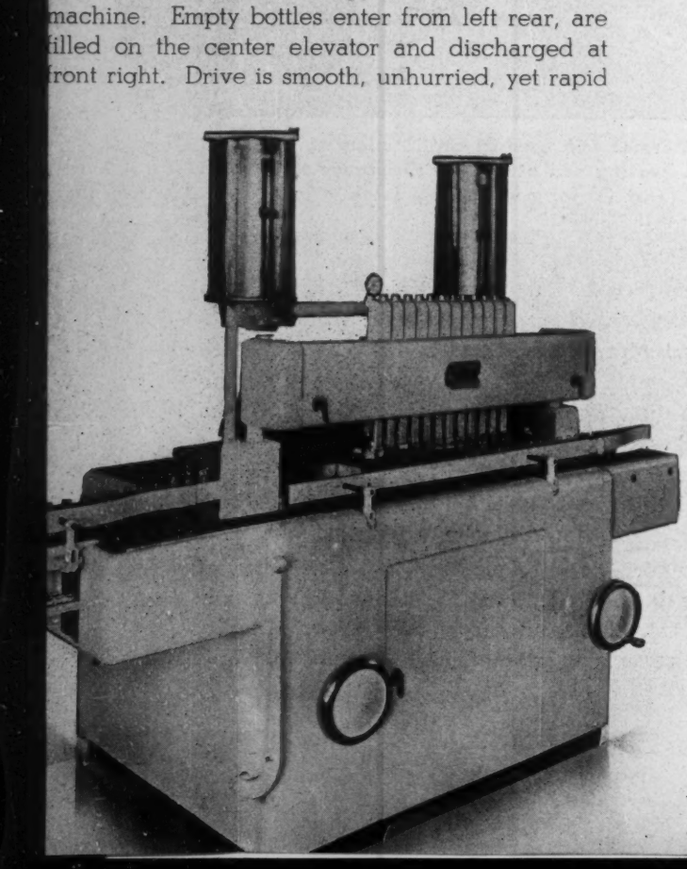
# Design F
# In New M

**A Pictorial Presentatio**
**chinery from the Stan**

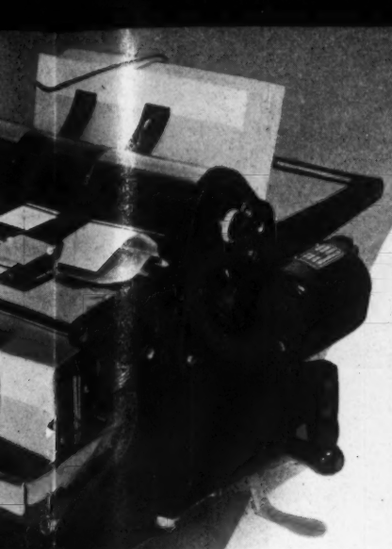
*(For new machine listing*

THIS MONTH'S COVE
rubber tired tractor and bott
Koehring trail dump has a
nection between the wagon
attaining a speed of 20 mile
gasoline or diesel engine is use
has four speeds forward and or
is equipped with an automati
anism actuated by a cam on
tensile, low alloy steel is spec

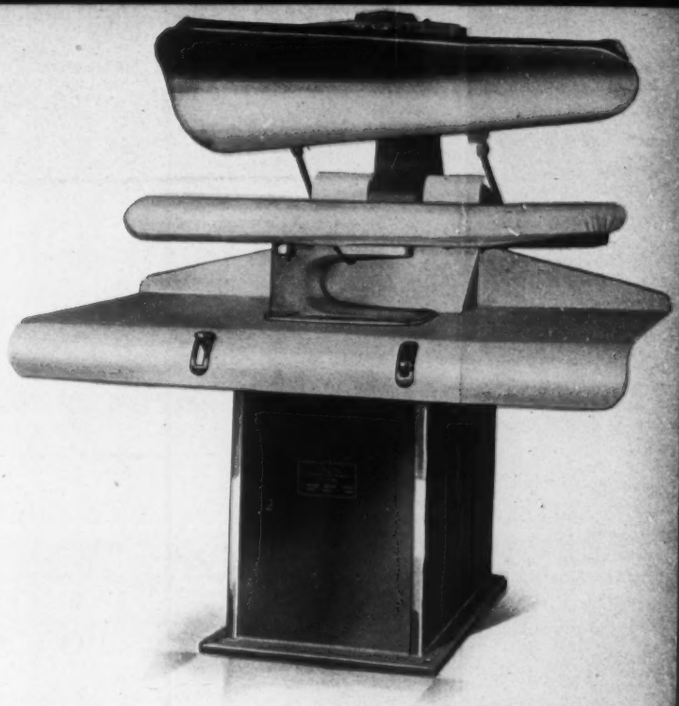
White porcelain enamel and stainless steel combine to make the Pneumatic super-fast filling machine (below) a sanitary unit for the packaging industry. Exterior controls are few and have been constructed to blend into the general contours of the machine. Empty bottles enter from left rear, are filled on the center elevator and discharged at front right. Drive is smooth, unhurried, yet rapid



Stenotype shorthand machine (right) has attractive plastic frame. A specially designed friction clutch spaces automatically and permits paper tape to be pulled either forward or backward. All mechanism is cadmium plated. Self-lubricating bearings are used for minimum wear and noiseless operation. Paper tape is fed by friction, automatically folding into a bundle in tray at rear



Main frame of the Multistamp letter folding machine (left) is aluminum alloy with baked black wrinkle finish. Motor with worm drive reduction unit is attached to the main side frame. The stacking device is actuated gradually backward by worm drive to accommodate an increasing stack of folded pieces. A synchronized bevel gear and worm movement closes and opens four paper jaws from all corners simultaneously to square unfolded paper



# Features
# Machines

## sentation of Recent Ma-
## ne Standpoint of Design

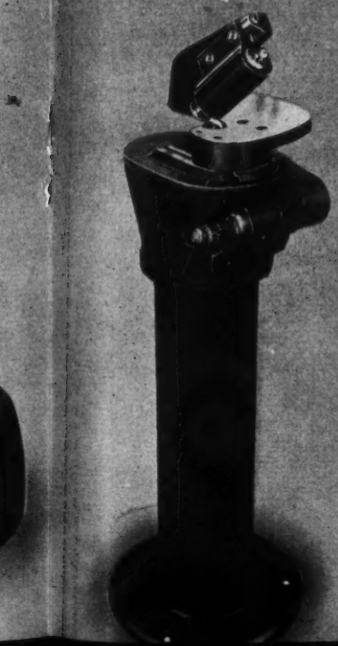
*chine listing see page 106)*

COVER. A combination
and bottom dump wagon, the
p has a universal hitch con-
wagon and tractor, the latter
20 miles per hour. Either a
gine is used in the tractor, which
rd and one reverse. The wagon
automatic door closing mech-
cam on the rear wheel. High
l is specified to reduce weight

Ironing head of Troy press (above) is made of heat treated aluminum alloy. It automatically adjusts itself to materials of varying thickness by means of an equalizing beam attached to the pressure arm. Frame is welded steel with polished chromium trim. Yoke is semi-steel, nickel alloy casting which is mounted on roller bearings

A shielded one-fourth-horsepower motor by means of a belt drives one of the two pulleys on which the grinding belts revolve in the Fisher laboratory grinder (above). The idling pulley has a counterbalancing weight attached to keep belt tension uniform. Housing is finished with black and gray crackle

Husky spindle of the Delta shaper (below) is manganese steel, carried in sealed ball bearings requiring no additional lubrication. Table is heavy cast iron, ribbed carefully to prevent warping. Spindle is set by an accurate helical gear and screw adjusting mechanism. Ring guard is fully adjustable and protects operator from accidental contact with work



Two speeds for both cutting and flanging are available on the Quickwork throatless shear and flanger (left). Smooth action of the self-feeding rotary cutters enables machine to follow intricate layouts. Ball bearings are used without, the cutter and roll shafts having permanently sealed bearings

MACHINE DESIGN Editorial

# Let's Take Aggressive Attitude Regarding Machines

WHAT will 1940 bring in the way of new and improved machinery to benefit mankind? While only time can answer this question, the coming months will see many new and revolutionary machines. In shaping their development, the engineer has a major part and a deep responsibility. Pausing to reflect with respect to ways and means to provide for a more abundant and useful 1940, there is one weakness that bears watching. It is habit.

Human nature inherently resents the changes demanded by progress. Habit in this sense is an obstacle. Periodically the rabble rousers, appealing to this trait, point accusingly at the machine as the creator of all human ills. While an always curious public listens to their gross misstatements, the enterprising engineer is carefully and thoughtfully planning new developments that will help his fellow men.

Obviously the engineer must firmly resolve to guard against this human weakness and ignore the critics that seek to destroy the incentive to design better and more efficient machinery. Accusations that much unemployment is due to the displacement of the human element by mechanical equipment, often fall on receptive ears, with the result that in some few instances, there has been a step backward. But despite these obstacles, political and otherwise, mechanical development continues to better the lot of everyone.

Recently it became necessary in a specific instance, to design a piece of supplementary equipment to extend the automaticity of a machine. Only by mechanical means could the production of the machine be increased to meet the output requirements. The device was installed and instead of the one operator originally required, a second was necessary to take care of the increased production. Higher speeds do not replace men—on the contrary they increase employment by permitting greater manufacturing output resulting in economies which are reflected in more and better goods at lower prices to the ultimate consumer. Thus is our standard of living improved.

# Professional Viewpoints

MACHINE DESIGN WELCOMES COMMENTS FROM READERS

## " . . . . suggest dyed aluminum"

*To the Editor:*

THE article by Mr. Van Doren on nameplates is good advice for the designer, for the manufacturer, and for the salesman. He stresses simplicity of lettering and layout, and the point of relating nameplate to the form of the product. These are significant points often overlooked in the mad rush to name an article.

The tendency today is to play down the company or maker's name and to play up that of the machine as simply as possible. This follows procedures and trends in other fields—such as home-appliances and automobiles. Consumer buying is simplified when one can ask for things seen or heard by name only. A single word is best remembered, advertisers sense and practice this constantly. Some products still carry the maker's name as a sign of integrity and reliability, displayed prominently. This is good of course, but a tradename is more often remembered and repeated by word of mouth. Toastmaster, for instance, as a word is accepted to mean quality merchandise. A few of the 1940 automobiles display veritable signboards on the rear—long prominent names detested by discriminating buyers.

Modern typefaces accompany nameplate designs to bring them up to date and make them attractive. The use of such styles as Bernhardt Gothic, Inland Gothic, Bayer, Corvinus, Kabel, Phenix, Stencil-block, Futura, Neuland, and Inline styles are in keeping with good printing and typographic work of today. The lettering can be worked out as a band or solid bar—for decorative effects—to be read on closer inspection. Abstract geometric handling of the word, or words, or lines of words within a nameplate makes for pleasing unity.

Color gives emphasis—red attracts and blue recedes—so a red nameplate can be smaller in size than a blue one and not lose its effectiveness. Attractive colors help us remember a trademark. Color may be obtained through the use of dyed aluminum. This process offers many possibilities. The metal can be dyed a soft rich yellow, for instance, then the required word or words printed (by press) on it in a resist, the piece dipped into a red-purple dye bath and then dryed, next, the resist washed off leaving the yellow show through the red-purple background. The colors are practically unlimited in range and combination, depending on how permanent they should be. About seven colors can be guaranteed fast to light and weather. Rich, soft appearing nameplates of good colors that reflect color harmony and taste are rare.

—S. G. WARNER
*Ann Arbor, Mich.*

## " . . . allows increased live load"

*To the Editor:*

THE amount of live load carried by crawler type excavators and the radius at which it can be handled is greatly affected by the deadweight of the boom. The lighter the boom, the greater the maximum live load for a machine of a given weight. Booms that are strong and yet light have been developed which employ alloy steel for chord members and arc welding to the greatest extent possible.

Structural alloy steels of comparatively low carbon content and suitable for welding have usually been selected. These steels have a minimum yield point of 50,000 pounds per square inch and also have high ductility values which are desirable. These booms are being built utilizing either alloy structural angles for the chord members with lateral members made of either angles or steel tubing.

A further advance has been made by constructing booms entirely from steel tubing. Mild steel tubing for the chord members as well as for all of the lateral members give high efficiency. Alloy steel tubular booms can safely carry loads about 45 per cent greater than mild steel booms of the same weight. The load carrying capacity of booms of this type has been found by actual experimental tests, which were carried to a point of destruction, to vary in the direct ratio of the yield point of the material as compared with the load carrying capacity of a boom of the same design constructed from mild steel.

—H. C. HETTELSATER
*Harnischfeger Corp.*

# Men of Machines

HAROLD E. MILZ

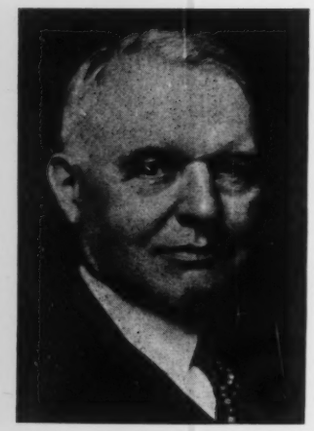
AFTER thirteen and a half years spent in building materials, handling equipment involving the design of mechanical, electrical and hydraulic mechanisms, Harold E. Milz has been appointed chief engineer of The Mercury Mfg. Co.

Born in Chicago, Mr. Milz received his technical training at Chicago Technical college, from where he graduated with a mechanical engineering degree. In March, 1926 he joined the engineering staff of Mercury and spent some years detailing and developing the company's line of industrial trailers and tractors, gasoline engine driven and storage battery propelled. Four years later when the management entered the electric lift truck field, he assisted in the design of this new line which included many radical departures such as the hydraulic lift, all-welded frames and full magnetic control. Previous to his present appointment, he has been developing the company's new electric fork trucks.

HAROLD G. SMITH

SINCE graduation Harold G. Smith has concentrated on engine designing, especially the internal combustion engine. In his new capacity as special engineer of the diesel and gasoline engine division of The Buda Co., his broad knowledge in this field will be invaluable.

His early experience includes one year with the Kelly Springfield Motor Truck Co., five years with The Foos Gas Engine Co., and twenty-three years with Hercules Motor Corp., in engineering capacities. He was chief engineer for the latter company from 1920 to the time of his resignation to accept the position with the Buda Co. During his engineering career, Mr. Smith has been connected with the design of the automotive type medium and high speed diesel engines, gas and gasoline engines of two, four and six cylinders, and from 1½ to 200 horsepower, stationary and automotive.



JAMES E. GLEASON

THE highest honor which may be bestowed upon an American mechanical engineer by The American Society of Mechanical Engineers—the A. S. M. E. Gold Medal—has been awarded to James Emmet Gleason. Mr. Gleason, president of Gleason Works, Rochester, N. Y., received the award "for his technical and engineering contributions" and "distinguished service to the automotive industry by making possible better and safer gear drives . . . . through the building of machinery for the production of gears that are found in all parts of the manufacturing world."

A native of Rochester, N. Y., he received his mechanical engineering training at Cornell. He then worked with his father designing and building lathes and planers manufactured by the Gleason Tool Co., founded in 1865. In 1874 the first commercially successful bevel-gear cutting machine was developed and patented by his father; and later, in 1905, James

Gleason took out patents on a two-tool bevel-gear generator, a machine for cutting both sides of bevel gear at the same time. Eight years later he developed the spiral bevel-gear generator—the first machine of its kind, and the basis of machines used extensively in automotive concerns here and abroad. Among his many activities, Mr. Gleason was president of the National Machine Tool Builders' association from 1926 to 1927.

♦

JOHN S. BARTEK has been added to the engineering staff of Pioneer Engineering & Mfg. Co., Detroit. He had formerly been chief engineer of Modern Tool Works, Rochester, N. Y.

♦

HAROLD J. STEIN, who has been connected with Allis-Chalmers Mfg. Co., Milwaukee, since starting in 1916 as a student apprentice has been named director of research, chemistry and metallurgy, of the manufacturing department. He had been chief research engineer since 1936.

♦

GREGORY J. COMSTOCK has been named associate professor of powder metallurgy at Stevens Institute of Technology. CLAIR C. BALKE has been appointed his assistant.

♦

EARLE K. RAMBO, having completed his survey on farm machinery in seven counties of Tennessee for the state extension service, has returned to his regular duties as instructor in agricultural engineering, University of Tennessee.

♦

C. J. HOLSLAG, president, general manager and chief engineer of Electric Arc Cutting & Welding Co., Newark, N. J., recently was the recipient of the Samuel Wylie Miller medal, donated by the American Welding Society.

♦

JOSEPH JANDASEK has been appointed research engineer of Hydraulic Brake Co., Detroit. Mr. Jandasek was formerly with the marine division of Bendix Aviation Corp., Brooklyn.

♦

GEORGE T. HORTON has been elected president, American Welding society, and has been inducted with other officers for 1939-40 during the society's annual meeting.

♦

KENNETH H. CONDIT has been appointed dean of the school of engineering, Princeton university. Among his many connections Mr. Condit had been a member of the university's teaching staff, and more recently editor of *American Machinist*. Previous to his present appointment he was executive assistant to the president of National Industrial Conference Board. Mr. Condit is a mechanical engineering graduate of Stevens Institute of Technology. In his latest capacity he succeeds ARTHUR M. GREENE JR. who will retire after being dean since 1921.

♦

JOHN G. LEE has been appointed assistant director of research in charge of the technical branch, United Aircraft Corp., East Hartford, Conn.

♦

THOMAS D. LANE has recently been made chief engineer of Lonergan Mfg. Co., Albion, Mich. He was formerly production engineer with American Gas Machine Co.

♦

J. H. NEAL, formerly assistant professor of agricultural engineering at University of Minnesota, has been appointed head of the agricultural engineering department, Alabama Polytechnic Institute, Auburn, Ala.

## Recognizes Welding Progress

CULMINATING a 2½ year program of scientific study, the James F. Lincoln Arc Welding Foundation will pay $200,000 in awards for progress in the field of arc welding applications. Reduction or elimination of hazards to safety and health, greater availability of comforts and conveniences through reduced prices, greater utility and durability of machines and structures as well as industrial benefits such as cost savings and other advantages in manufacture, fabrication or construction are types of the studies encouraged. These large scale benefits involve machines, products and structures of all kinds including transportation equipment; structures; heating, air conditioning and refrigerating equipment; farm machinery; road-building equipment, as well as industrial machines and products.

Significant of the importance of machinery manufacturing is that over half of the value of the awards is available to this field. Awards range from $100 to $13,700, there being a total of 458. Participation is open to everyone who plays any part in actually bringing about progress in the executive, design, fabrication, manufacture, construction, or maintenance phases.

Studies may discuss progress in industrial development within the 2½ year period, January 1, 1940 to June 1, 1942. Such progress may involve redesign and manufacture or construction of an existing machine; new design and manufacture or construction of a machine; organization, development and conduct of a welding service; development, planning and performance of maintenance or repair work with arc welding. All inquiries concerning the award program should be addressed to Secretary, The James F. Lincoln Arc Welding Foundation, Cleveland, Ohio.

# ASSETS *to a* BOOKCASE

### Cast Metals Handbook

*Published by the American Foundrymen's association, Chicago; 636 pages; cloth bound; available postpaid through* MACHINE DESIGN, *$3 for members, $4 for nonmembers.*

This 1940 edition is the second of a volume which first appeared in 1935, and records in addition to the information previously presented, the progress made in foundry work during the past four years. Data has been selected for the express purpose of enabling designers, engineers, and other users of castings to pick the material best suited for the purpose. Another aim is to facilitate co-operation with foundries in obtaining castings in the most satisfactory manner.

The handbook is divided into seven sections, the first dealing in part with points to be considered in casting design and the selection of material suited to the particular application. Second section deals with cost information and the third discusses the significance of strength and ductility tests of metals. The last four sections are devoted to the properties and applications of cast steel, malleable iron, nonferrous alloys and cast irons, respectively. Particularly valuable in these sections is a discussion of the effect of various alloys on the physical properties.

□ □ □

### Patent Fundamentals

*By Adelbert Schapp; published by The Industrial Press, New York; 168 pages, 5⅜ by 8⅜ pages, cloth bound; available through* MACHINE DESIGN, *$2 postpaid.*

Nontechnical language and practical examples aid the author in explaining the underlying principles of true invention, procedure in obtaining patent protection, drafting effective claims, making assignments, issuing licenses; in brief, how to protect both invention and inventor. By studying this information, the inventor should become a fair judge of patent claims, and engineers will be better able to co-operate intelligently with patent attorneys in preparing and prosecuting patent applications. The chemist's problem is discussed and there is an analysis of decisions relating to chemical patents.

Further information on trademarks and copyrights, design patents, prints and labels is included, and the different conditions under which these protective measures become available are explained.

□ □ □

### Problems in Mechanics

*By G. B. Karelitz, J. Ormondroyd and J. M. Garrelts; published by the MacMillan Co., New York; 271 pages, 6 x 9¼ inches, cloth bound; available through* MACHINE DESIGN *for $2.50 postpaid.*

This book contains a collection of problems with answers covering statics, kinematics and dynamics. The problems are preceded by a brief outline of theorems arranged in a systematic way, useful as a convenient reference. Special sections on bearing reactions, vibration and oscillation and impact are included.

□ □ □

### Industrial Market Data Handbook

*By O. C. Holleran; published by Department of Commerce, Washington, D. C.; 907 pages, cloth bound; available through* MACHINE DESIGN, *$2.50 postpaid.*

Complete figures on industrial production, employment, value of products, cost of material, fuel and power, and output per wage earner for each of the 3,070 counties in the United States, and similar data for every city of more than 10,000 population are contained in this valuable handbook. Prepared as a co-operative study by the Bureau of Foreign and Domestic Commerce, the Census bureau and the Bureau of Mines, this book is particularly helpful to executives, especially in estimating sizes and locations of markets together with the potential value of these markets. Undoubtedly it is the most complete assembly of statistical data dealing with markets now available to business men.

County locations of 169,111 manufacturing plants are tabulated by kinds of industry, with parallel tables covering county locations of 23,000 mines. Two hundred and eighty industries are covered, for which there is information dealing with channels of distribution and manufacturing operation costs, as well as a key table on wholesale operation in a number of heavy industries.

# NO CHATTER HERE

# THE SPINDLE ROLLS ON TIMKEN BEARINGS

Responsibility for precision in this LeBlond Heavy Duty 16" Lathe rests largely on the capable tapered rolls and races of TIMKEN Roller Bearings—as it does in so many other models of LeBlond lathes.

The R. K. LeBlond Machine Tool Company, in common with most leading manufacturers of heavy duty machine tool equipment, find that TIMKEN Bearings cover all requirements of accuracy, economy and endurance.

They hold spindles rigid in the face of the most racking radial and thrust loads, yet keep them turning with utmost freedom and smoothness; maintain correct and constant alignment of shafts in the driving and feed mechanisms thereby assuring accurate gear contact; and reduce wear to the vanishing point. Specify "Timken Bearing Equipped" when buying heavy duty machines of any kind.

## TIMKEN
### TAPERED ROLLER BEARINGS

Manufacturers of TIMKEN Tapered Roller Bearings for automobiles, motor trucks, railroad cars and locomotives and all kinds of industrial machinery; TIMKEN Alloy Steels and Carbon and Alloy Seamless Tubing; and TIMKEN Rock Bits.

**THE TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO**

# NOTEWORTHY PATENTS

## Determines Spark Advance

AUTOMATIC spark advance for ignition systems which responds to manifold and engine oil pressures is provided by the device illustrated in *Fig.* 1. Designed by Kenneth A. Browne and assigned to Wright Aeronautical Corp. this automatic coupling

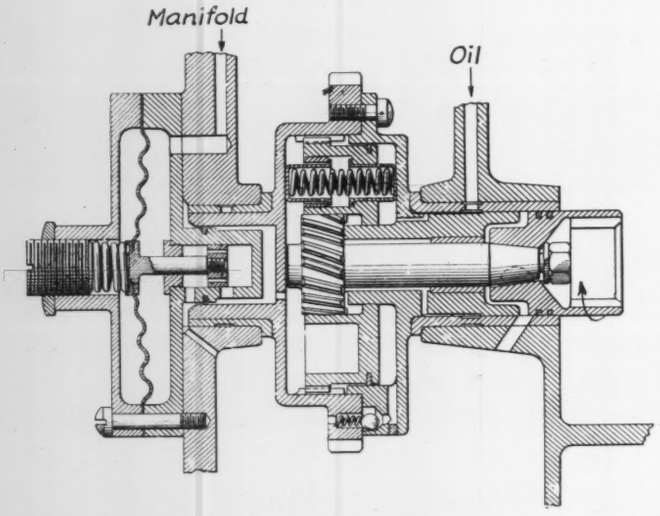



*Fig.* 1—*Speed and oil and manifold pressures of engine determine degree of spark advance*

varies the spark advance according to requirements during full power, cruising power, idling and starting conditions.

Springs normally hold an hydraulic piston centrally in its cylinder. Oil pressures on each side of the piston advance or retard the spark according to operating conditions by moving the piston to right or left respectively. This movement causes relative rotation of shaft and coupling through a helical spline. Differential in pressure is obtained by action of the manifold pressure on a diaphragm and spring or centrifugal force unseating a ball valve.

As the engine starts, oil pressure builds up and, with throttle closed, the diaphragm is moved to the right due to low manifold pressure. This moves a valve and uncovers an oil passage reducing the pressure in the left side of the cylinder. The chamber on the other side fills with oil and as pressure builds up the piston is moved to retard the spark. Low idling speeds keep the ball valve seated.

When the throttle is opened, engine speed opens the ball valve by centrifugal force which reduces the pressure in the right-hand chamber. The springs then return the piston to normal spark advance. Further acceleration increases manifold pressure and moves the diaphragm to close its drain valve. This builds up the pressure in the left chamber and advances the spark farther. Full power throttle causes the diaphragm valve to open again by overtravel, giving normal spark advance.

## Has Constant Tension Control

EMPLOYING a differential mechanism and variable speed transmission interconnected as shown schematically in *Fig.* 2, a constant-feed material winding device provides constant tension on the web of material being wound. Thus the rate of speed of the winding reel varies as its diameter increases to maintain this constant tension.

Driven at constant speed by a motor are the material delivery rolls and one side of the differential gear unit. The imput shaft of the variable speed unit is driven by a belt with carefully adjusted tension to transmit a required torque to the unit. This adjustment determines the tension maintained on the driving reel by controlling the variable speed unit. When feed rolls and winding reel are the same diameter, they rotate at the same speed. Likewise both right and left side shafts of the differential mechanism turn at the same speed. When drums differ in size, the center shaft of the differential turns proportionately and adjusts the variable speed unit faster or slower as required. This control device was designed by William R. Perry and is covered by patent 2,168,071 assigned to Reeves Pulley Co.

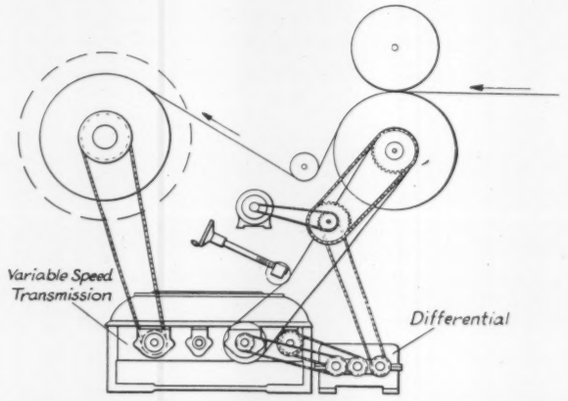



*Fig.* 2—*Arrangement of differential and variable speed transmission on winder drive*

MAZLO
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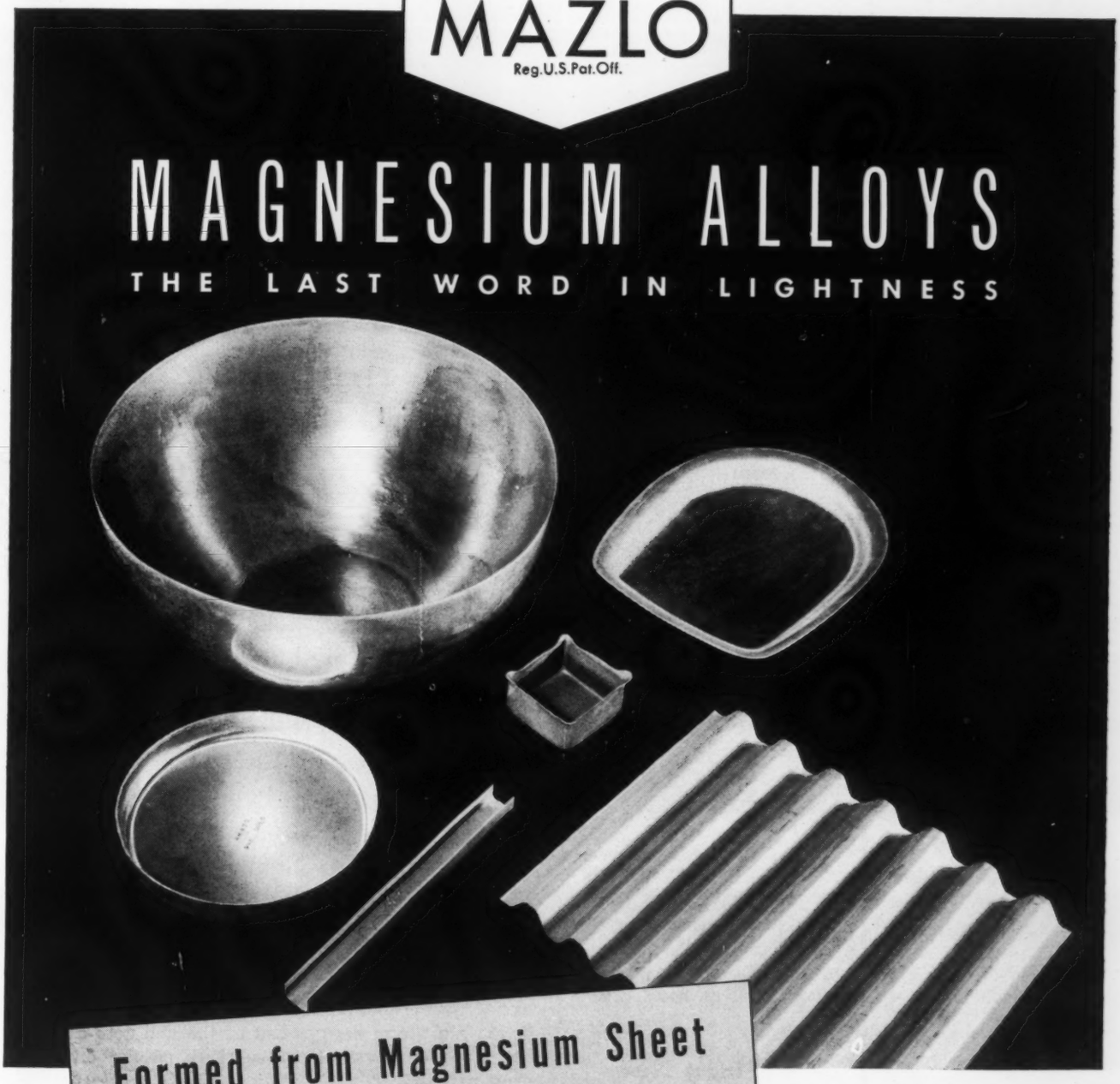
# MAGNESIUM ALLOYS

THE LAST WORD IN LIGHTNESS



**Formed from Magnesium Sheet**

These pieces, produced on standard metal-working equipment, demonstrate the versatility of MAZLO Magnesium sheet. It can be formed by bending, drawing and spinning. It lends itself readily to assembly by riveting, as well as gas, electric seam and spot welding.

As with all metals, certain methods must be followed in forming Magnesium, but they are neither complicated nor difficult. MAZLO engineers, who have been dealing for years in the technical and economic aspects of achieving lightness, will gladly advise you on methods of fabricating Magnesium.

MAZLO Magnesium Alloys provide a range of physical and fabricating characteristics. Use of this lightest of commercial metals enables you to go *very* light economically.

MAZLO manufacturing facilities offer Magnesium in every form: sand castings, permanent mold and die castings, extruded bar and shapes, sheet, tubing and forgings. *Sales Agent:* Aluminum Company of America, 1703 Gulf Building, Pittsburgh, Pennsylvania.

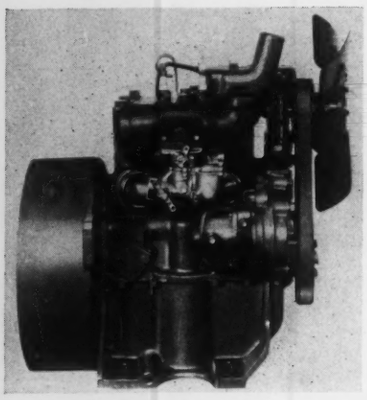
MAZLO

AMERICAN MAGNESIUM CORPORATION

# New PARTS AND MATERIALS

## Gasoline Engine Widely Adaptable

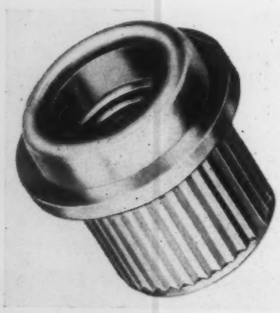
APPLICABLE to a wide variety of installations in industrial, agricultural, marine, oil field and even commercial vehicles, a smaller two-cylinder gasoline engine and power unit, designated model BXB, has been added to the line made by Hercules Motors Corp., Canton, O. Maximum torque is 28 pounds feet at 1200 revolutions per minute. For continuous peak load service the engine can be operated up to 1800 revolutions, at which speed it develops 9.2 corrected horsepower. Thermo-syphon cooling is standard on these engines, but water circulating pumps are available. Up-draft manifolds can be furnished in either the center or rear-up outlet type. Full force lubrication to all main and connecting rod bearings is supplied by a pump located in the oil sump, driven by helical gears from the main camshaft. Crankcase is cast integral with the cylinder block and carries the crankshaft support and two main bearings of ample proportion. The engines have L-head cylinders and valves have 30-degree seats.



*Smaller two-cylinder gasoline engine developing 9.2 horsepower has been added to line*

## Expand Line of Self-Locking Nuts

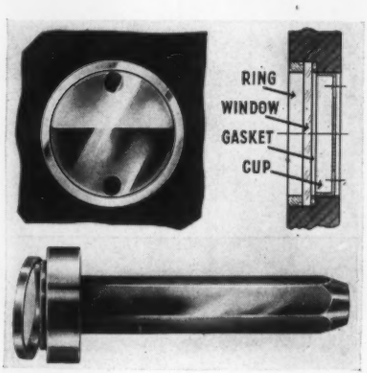
NINE new types of nuts, all embodying the basic self-locking element—a resilient nonmetallic collar built into the head of the nut—have been added to the line made by Elastic Stop Nut Corp., 1015 Newark avenue, Elizabeth, N. J. This collar, in resisting the entrance of the bolt or screw, forces the thread faces into a pressure-contact which is maintained after the nut is tightened. Thread play is eliminated and the nut cannot work loose. The new types of nuts are designated as thin hexagonal, spline, internal wrenching, countersunk and counterbored one-lug anchor, countersunk and counterbored two-lug anchor, countersunk corner anchor, bracket anchor, floating right-angle anchor and floating basket anchor.



*Self-locking spline nut one of nine new types of nuts with resilient collar built into head*

## Window Affords Oil Visibility

FOR general use in connection with oil reservoirs, containers and lubricators, Bijur Lubricating Corp., Long Island City, N. Y., has developed a sight oil window affording improved visibility. It is a self-contained unit, conveniently installed in a simple bored opening. The assembly consists of a chromium-plated ring, window, gasket and cup, all fitted snugly into a metal pocket. A drilled opening at the top of the cup and one at the bottom, permit free passage of the oil. The bright aluminum background of the cup acts as a reflector which gives sharp visibility of the oil level, even with imperfect lighting. Standard sizes of the window, specified according to the diameter of the aluminum reflector face, are ¾, 1-1/16, and 1-5/16 inches.

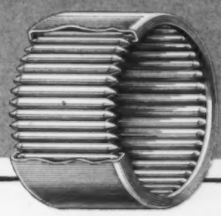



*Self-contained sight oil window has been developed for general use in connection with lubricating systems*

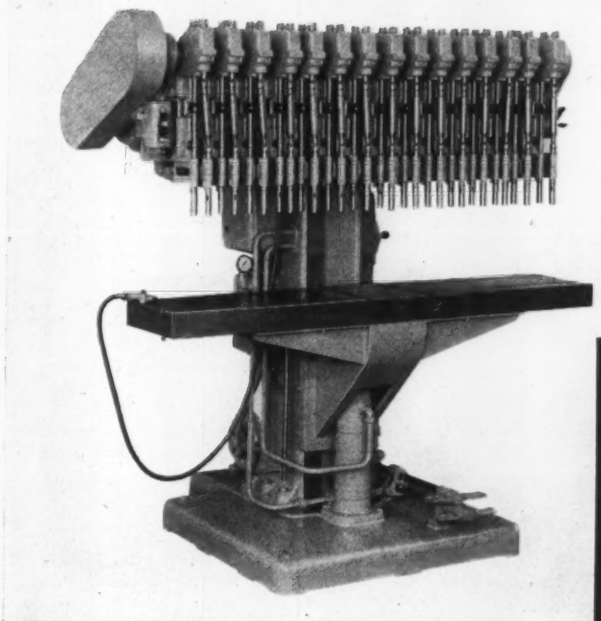
## Clutch Embodies Safety Features

A NEW series of overload release clutches has been added to the line made by The Conway Clutch Co., 1543 Queen City avenue, Cincinnati. Essentially a disk clutch, the new model also embodies automatic safety features. In one arrangement, it slips at a predetermined torque, permitting the machine to stop as soon as an obstruction or excessive torque is encountered. Under another arrangement, the clutch slips when an obstruction is encountered, but after a fraction of a revolution of slippage, the clutch disengages itself. If desired, it can operate a limit switch

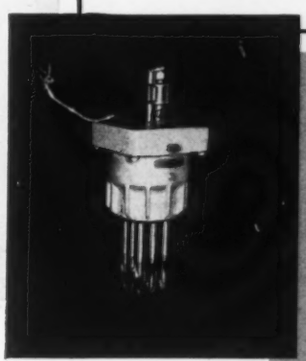
# No Bearing Replacement IN 4 YEARS



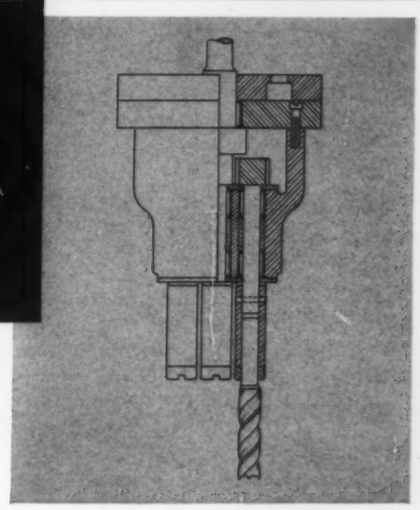
## TORRINGTON NEEDLE BEARINGS TAKE SPINDLE SHOCK LOADS THAT ONCE RUINED BUSHINGS



(*Above*) Intricate Multiple Spindle Drill in which 105 Torrington Needle Bearings give trouble-free performance under very close space limitations.



(*Above*) B. M. Root Company's 9-Spindle Fixed Center Drill in which 19 Torrington Needle Bearings are used.



(*Right*) Cross-section shows how Needle Bearings overcome space limitations and keep spindles in alignment.

HUNDREDS of multiple-spindle Fixed Center Drills equipped with Torrington Needle Bearings have been in service since 1935 with never a call for bearing replacements. B. M. Root Company of York, Pa., manufacturer of the equipment, states that *Torrington Needle Bearings have virtually eliminated servicing.*

One hundred and five bearings are used in the large unit shown above, and the B. M. Root Company says, "One of the greatest advantages is the fact that in many close-center applications it is the *only* anti-friction bearing that could possibly be used."

The full complement of rollers in these bearings provides many linear inches of contact with resulting high capacities. Small, light, simple in design, simple to install, they frequently allow economies in machine assembly in addition to increasing efficiency.

After Needle Bearings were installed in the 9-Spindle drill shown, higher speeds were obtained without additional provision for lubrication. Because of the lip construction of their retaining shells, these bearings not only retain lubricant for long periods but also keep out dirt and metal chips ruinous to bushings.

The Torrington Engineering Department will be glad to work with *you* in adapting the advantages of the Needle Bearing to *your* products. For further information write for Catalog No. 9. For Needle Bearings to be used in heavier service, request Booklet 103X from our associate, the Bantam Bearings Corporation, South Bend, Ind.

*The Torrington Company*
ESTABLISHED 1866
*Torrington, Conn., U.S.A.*
*Makers of Ball and Needle Bearings*
New York Boston Philadelphia Detroit
Cleveland London, England

**TORRINGTON NEEDLE BEARING**

LORD

*fractional horsepower*

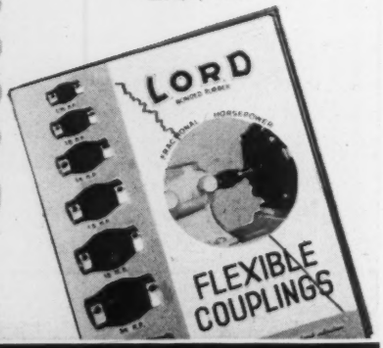
COUPLINGS

*for*

- AIR CONDITIONING EQUIPMENT
- REFRIGERATORS
- COMPRESSORS
- PUMPS
- BLOWERS
- FANS
- OFFICE MACHINES
- WASHING MACHINES
- HEATERS
- OIL BURNERS
- GENERATORS
- STOKERS
- RECORDERS AND REPRODUCERS, ETC.

do just that by taking up shaft misalignment—angular and parallel—with low bearing loads and negligible power loss. Eliminating fussy alignment speeds assembly and cuts costs. They absorb torsional vibration and stop the passage of motor hum and gear noise along the shaft. Lord Couplings are one piece bonded rubber units—easy to handle and install—pleasing in appearance. Write for bulletin No. 200.

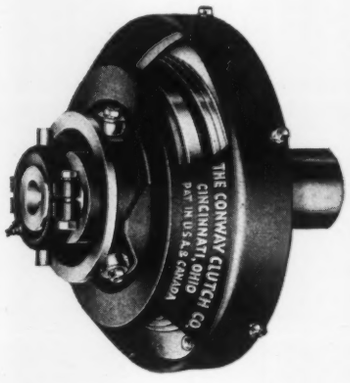
LORD MFG. CO.
ERIE, PA.




BONDED RUBBER JOINTS — LORD BONDED RUBBER — SHEAR TYPE RUBBER MOUNTINGS

NEW YORK CHICAGO BURBANK, CALIF.

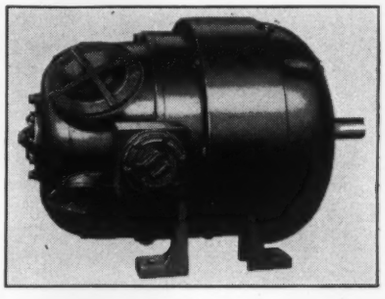

and disconnect electrical equipment. The clutch can be set to transmit any torque from nothing to its rated capacity and will keep this setting even after adjustment for wear.




*Automatic safety features have been embodied in new series of disk clutches*

## Large Explosion-Proof Motors

EXPLOSION-PROOF, direct current motors as large as 75-horsepower are now being made by The Reliance Electric & Engineering Co., Cleveland. Enclosed, fan-cooled, and equipped with ball bearings, the motors are designed to operate safely in places made dangerous by the presence of gases and vapors.

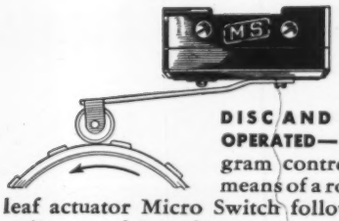


*Explosion-proof direct-current motors as large as 75-horsepower are now being made*

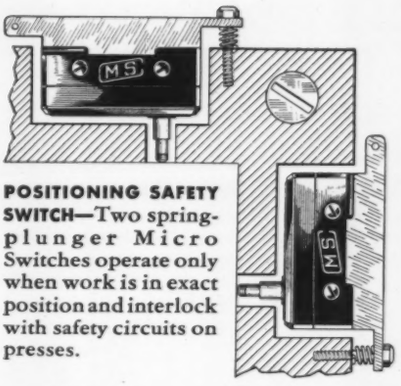
If gas or dust inside the housing is ignited, the flame is prevented from escaping to the outside air. At the same time, the enclosure has strength to withstand high internal pressure from gas explosion. In the event of a burnout, the housing will not reach a temperature sufficient to cause surrounding vapors to ignite.

## Control Station Attractively Styled

A THREE-BUTTON control station, attractively styled and designed for easy installation and long life, has been placed on the market by the Allen-Bradley Co., 1311 South First street, Milwaukee. Button mechanism is the unit type, mounted in a diecast box open at the front and two sides, with a conduit opening at one end. A heavy, U-shaped molded plastic cover, with reinforcing ribs, completes the enclosure. All terminals are out in the open when the cover is off, permitting easy installation and inspection. The double break, silver alloy contacts are mounted in individual chambers in a molded plastic block which protects them against accidental mechanical injury. This construction, along with the tongue-and-groove

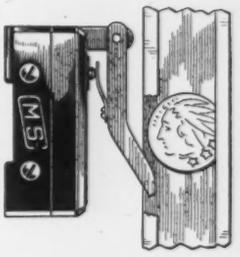


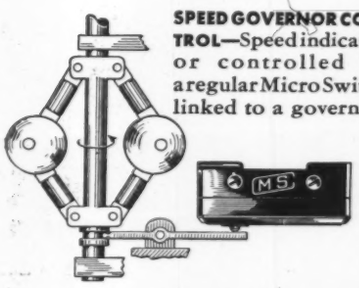
**DISC AND CAM OPERATED**— Program control by means of a roller-leaf actuator Micro Switch following strips on a driven drum.



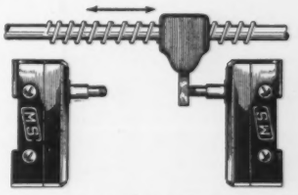
**POSITIONING SAFETY SWITCH**—Two spring-plunger Micro Switches operate only when work is in exact position and interlock with safety circuits on presses.

**COIN ACTUATED**—In a coin machine, the weight of a coin, through a simple lever, operates a regular sensitive Micro Switch.

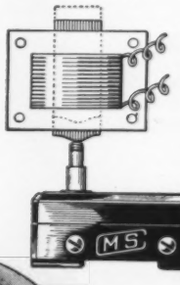




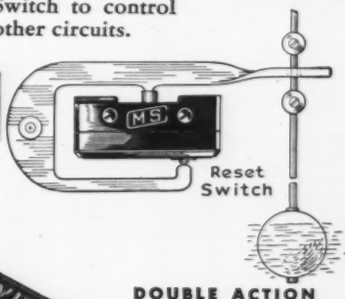
**SPEED GOVERNOR CONTROL**—Speed indicated or controlled by a regular Micro Switch linked to a governor.



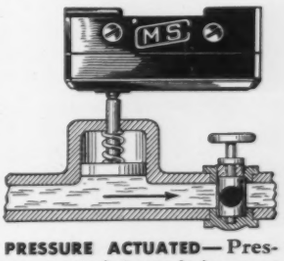
**SCREW LIMIT**—Screw operated carriage at each end of travel actuates a spring-plunger Micro Switch which reverses or stops motor drive.



**SOLENOID CONTROL**—Solenoid when pulled in operates a spring-plunger Micro Switch to control other circuits.




**DOUBLE ACTION FLOAT**—Liquid level control through the use of a reset Micro Switch and a lever operated by stops on the stem of a float.



**PRESSURE ACTUATED**— Pressure switch is made by combining a regular Micro Switch and a pressure operated plunger. The electrical circuit is thereby controlled by the opening and closing of the valve.

## If the Applications of the Micro Switch Shown Above Do Not Meet Your Design Requirements, Write Us for Complete Data

The design possibilities of this small, compact, sensitive precision snap-action switch are so broad that we cannot begin to illustrate all of them. Write for a complete set of data for your files. . . . The Micro Switch is 1 15/16″ long, weighs 1 ounce, operates precisely on small energy, small force and small movements at speeds as high as 600 times per minute and endures millions of operations. It's listed by Underwriters' Laboratories and has the approval of the Hydro-Electric Power Commission of Ontario.

*Also New!*

### A Streamlined Die-Cast Housing with Many Features

A sturdy and attractive die casting for enclosing all types of Micro Switches . . . Rugged terminals for No. 14 wire well supported on the switch and arranged for easy field connection . . . Underwriters' listed construction throughout. . . . No pigtails or sealing pitch necessary . . . Micro Switch readily replaceable . . . Hub takes ½″ standard conduit . . . Available in normally open, normally closed, or double throw circuits. Write for data sheet No. 5.

**MICRO MS SWITCH**

*MANUFACTURED IN FREEPORT, ILLINOIS BY*

MICRO SWITCH CORPORATION

New York Chicago Boston

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# MICRO MS SWITCH

OHIO GEARS

*help* **Buckeyes** *make wider roads!*

Road widening jobs move faster and interfere less with traffic when excavation for the subgrade is done with the Buckeye Highway Widening Machines. Digging up to a mile of trench per day, and leaving that trench clean, true to grade and ready to receive materials calls for accuracy, toughness and sturdy dependability in every part of the Buckeye machine.

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"We've used Ohio Gears for over ten years," they say, "and have always found them fully up to specification and thoroughly uniform. We've been pleased, too, with the service and friendly co-operation of the Company.

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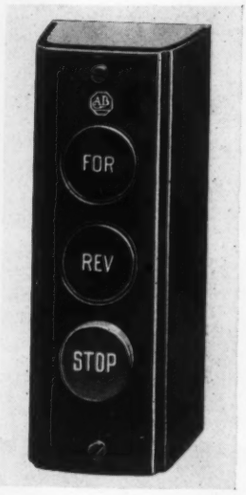
St. Louis Tool Co.,
2319 N. Ninth Street

OHIO GEARS

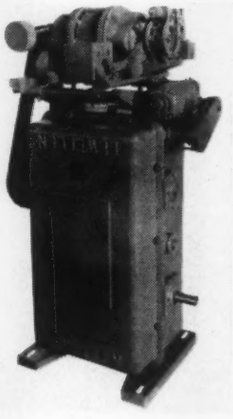

design of the seam and the snug fit of the flanged buttons into the recessed cover, makes it difficult for dirt and grit to enter the station and interfere with its operation.




*Mechanism of three-button control station is unit type, mounted in diecast box open at front and two sides*

## Transmission Keeps Strip Taut

A SPECIAL variable speed transmission with electrical control has been developed by Lewellen Mfg. Co., 1010 East Tenth street, Columbus, Ind., for maintaining uniform tension in winding strip metal. In operation, the winding reel starts at its highest speed and as the strip of material on the spool increases in diameter, the control accurately reduces the speed of the reel to constant tension. After the reel is filled and the unit stopped for insertion of a new core, the control reverses its position to allow the new reel to start again at maximum speed and decrease in speed as it is filled.



*Uniform tension in winding strip metal is maintained by special variable speed transmission*

## Method Coats Light Metals

COLSEALING, a new method of coating light metals, is announced by the Finishes division, Colonial Alloys Co., East Somerset, Trenton avenue and Reading railroad, Philadelphia. Colsealing changes the surfaces of the metals and converts them into millions of minute molecular groups within which the finish becomes securely bonded. It is said to provide

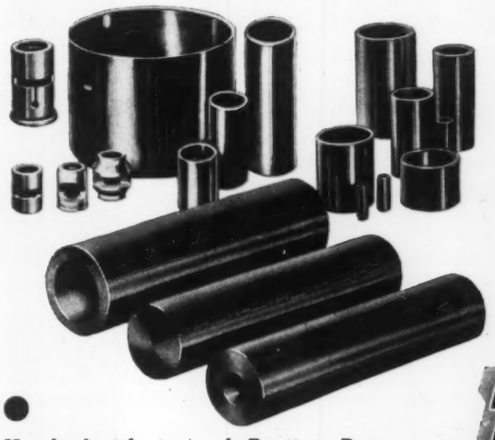
# WHEN YOU NEED AN ELECTRIC MOTOR *Bearing!*—

YOU DON'T HAVE TO HUNT FOR IT!
YOU DON'T HAVE TO WHITTLE IT OUT YOURSELF
YOU DON'T HAVE TO CARRY A LARGE INVENTORY
MOTOR BEARINGS
JUST PHONE THE BUNTING WHOLESALER

● Bunting Bearings are available from stock for all makes of electric motors from 1/50 hp to 100 hp. Ask your electric supply wholesaler . . . Write for catalog . . . The Bunting Brass & Bronze Company, Toledo, Ohio. Warehouses in All Principal Cities.

**A Free Consulting Service**

**Bunting's Product Engineering Department can give you valuable aid in making specifications for bearings for any application. Tell us your problems. Send us your blueprints for quotations.**

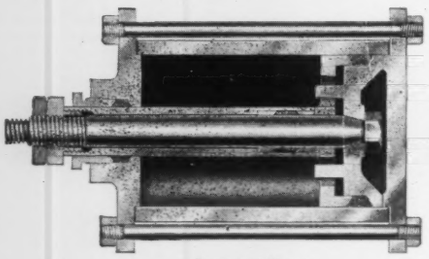


● Hundreds of sizes of Bunting Bronze Standardized Bearings for all mechanical applications constantly carried in stock by mill supply wholesalers everywhere and Bunting Warehouses. Tubular and Solid Precision Bronze Bars. Ask your wholesaler. Write for catalog.

**BUNTING**

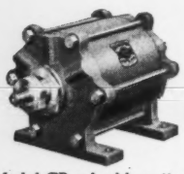
BRONZE BUSHINGS · BEARINGS
PRECISION BRONZE BARS · BABBITT METALS

# MORE *Usable* POWER



Sectional View

Model BR—double-acting air cylinder



Model CR—double-acting air cylinder

**Hannifin Pneumatic Cylinder construction cuts friction losses to the minimum, providing greater usable power. Hannifin cylinders are bored and then honed, producing a straight, round, perfectly smooth cylinder finish. The soft, graphite-treated piston packing is adjustable from outside the cylinder, allowing easy maintenance of the high efficiency piston seal.**

**These Hannifin features not only prevent leakage and waste of air power, but keep friction loss at the minimum. Tests show Hannifin cylinders have less than 40% of the starting friction and less than 30% of the moving friction of ordinary types.**

**Hannifin cylinders are built in a full range of standard types, sizes 1½ to 16 in. diameter, for any length stroke. Larger sizes built to order. Single or double-acting types, furnished with or without air cushion. Write for Bulletin 34-MD; also Bulletin 35-MD on hydraulic cylinders.**

**HANNIFIN MFG. COMPANY**
**621-631 South Kolmar Avenue**
**Chicago, Illinois**

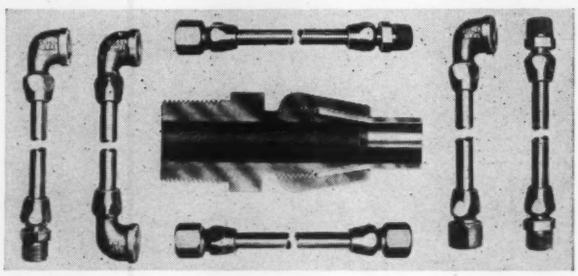
**ENGINEERS • DESIGNERS • MANUFACTURERS**
***Pneumatic and Hydraulic Production Tool Equipment***

# HANNIFIN
*high efficiency* **AIR CYLINDERS**


an excellent adhesive and protective base for paints and lacquers and renders surfaces resistant to severe atmospheric conditions.

## Connectors for Tubing on Market

AVAILABLE in sizes ⅛ to 2-inch in various adaptations as shown in the illustration, Superseal connectors for use with aluminum, brass, copper and steel tubing are being made by the Superseal Corp., 300 Fourth avenue, New York. Effectiveness of this type of connector is caused by the design of the couplings, which employ an exclusive compression joint,

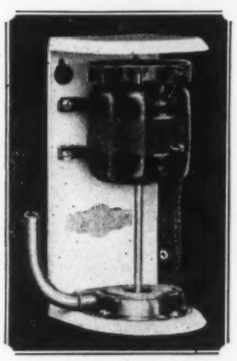


*Effectiveness of type of connector for use with metal tubing is caused by design of couplings*

sealed both inside and out with ends of the tubing flared to a 20-degree angle. This provides a long flare which makes an absolutely tight seal with the tubing wedged between the self-aligning compression nut and the fitting. Cutaway view illustrates this point.

## Announce Stainless Steel Pump

MADE of stainless steel and mounted on a vitreous porcelain enameled stand, a new pump has been developed by the Air-O-Line Co., Dallas, Tex. It is made in three sizes ranging from 140 to 360 gallons per hour and is claimed to be one of the most efficient small pumps in the low priced field.



*Small pump made in three sizes is stainless steel and mounted on porcelain stand*

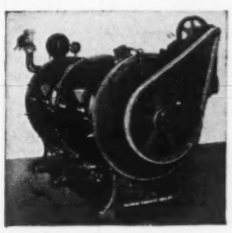
## Switch Transfers Load in Emergency

ZENITH ELECTRIC CO., 845 South Wabash avenue, Chicago, is now manufacturing a new automatic transfer switch, spring gravity drop-out type, for automatically connecting a lighting or power load to an emergency source in case of failure. The unit is available in one, two, three, or four-pole construction. Cur-

# What Design Engineers are doing with Silverlink Roller Chain!

## Giant 30-Ton Trucks Driven by SILVERLINK ROLLER CHAIN

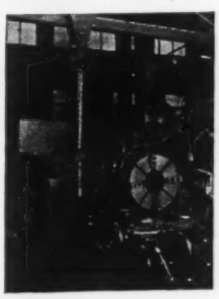
Two of these giant Mack trucks were built for strip mine haulage. Each has a body capacity of 40 cu. yds., and will hold 30 tons of coal. They are 6-wheelers, with the 4 dual-tired driving wheels in the rear being driven with Silverlink roller chain. Silverlink has set the pace for dependable long life peformance in severe service of this kind.



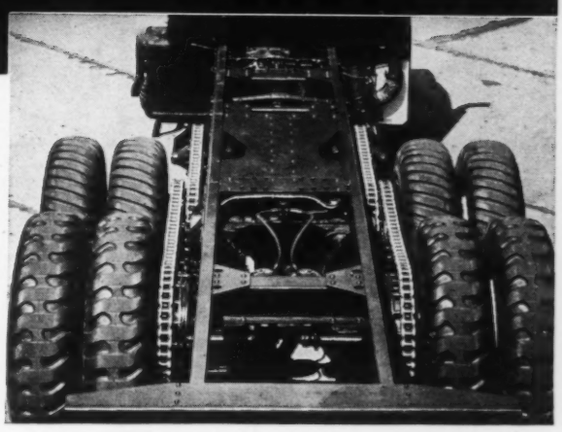
### Hospital Laundry Machine Quiet, Dependable

The Henrici washing machine employs a Link-Belt Silverstreak silent chain drive on the first reduction from the motor, and a triple-width Link-Belt Silverlink roller chain from the first reduction to the sprocket wheel on the washing machine cylinder. The Henrici organization states that hospital engineers and mechanics are enthusiastic about the silent, smooth operation of these chain drives, that they give smoother acceleration, that they have simplified the matter of lubrication, made adjustments easier, and have practically eliminated repair expense.

### Light Weight Electric Hoist Uses Silverlink



The "Budgit" Hoist, which is a product of the Shaw-Box Crane and Hoist Division of Manning, Maxwell and Moore, Inc., weighs only 58 pounds and has a 500-lb. lifting capacity at a speed of 17 ft. per minute and operates from light socket, with no additional wiring required. To obtain the performance that this new hoist gives, with a unit so light in weight, Silverlink roller chain, instead of the usual link lifting chain, is employed.



● Design and plant engineers alike recognize the value of Silverlink's accurately finished, all-steel construction, built to the highest standards of precision . . . that it combines great strength with comparatively light weight . . . that it is extremely flexible, assures smooth operation, and is especially capable of withstanding severe shocks . . . that it minimizes wear and repair. They recognize, too, the value of Link-Belt engineering service in working out problems in connection with the use of roller chains for conveying and power transmitting. Send for Engineering Data Book No. 1757. It is a hand book of roller chain practice and design.

**LINK-BELT COMPANY** 7828

Indianapolis Chicago Philadelphia Atlanta
San Francisco Toronto
Branch Offices and Distributors in Principal Cities

**LINK-BELT**
*Silverlink*
**ROLLER CHAIN**

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KNURLED

UNBRAKO

SOCKET SCREWS

**for their BETTER GRIP PERFECT FIT LASTING HOLD**

• **BETTER GRIPPING HEAD** Knurled heads—found only on "Unbrako" Products—provide a non-slip gripping surface for the mechanic's fingers or pliers. This means time saved on production jobs—and time saved is money in your pockets.

• **PERFECT FIT** Strong, tough alloys precisely machined and then rigidly inspected insure a uniformly perfect fit for each "Unbrako" Socket Screw.

• **LASTING HOLD** By two simple effective methods "Unbrako" Socket Screws can be locked into place after countersinking in either hardened steel, cast iron or soft metals.

No other screw has all the advantages of Knurled "Unbrako"—write for our catalog and samples.

Fig. 1446 "Unbrako" Socket Head Stripper Bolt with the "Better Gripping Head"

Fig. 1434 Knurled "Unbrako" Socket Head Cap Screw, U.S. and Foreign Pats. Pending with the "Better Gripping Head"

**STANDARD PRESSED STEEL CO.**

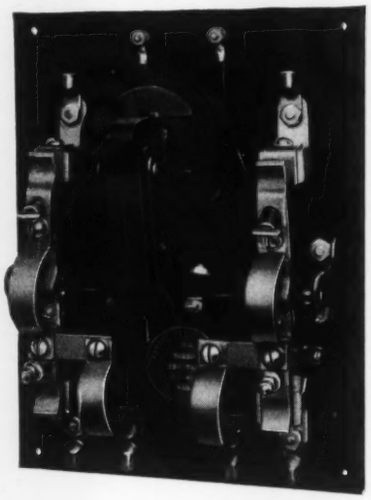
BRANCHES BOSTON DETROIT INDIANAPOLIS

JENKINTOWN, PENNA.

BOX 102

BRANCHES CHICAGO ST. LOUIS SAN FRANCISCO


rent capacities range from 30 to 300 amperes. The switch will transfer when the voltage of the circuit drops to 70 per cent or less and will restore the load to the normal source when the voltage reaches 90 per cent. Contacts are copper to copper and operate with

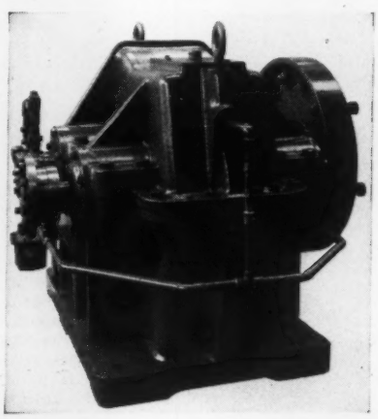


*For automatically connecting lighting or power load to an emergency source, new automatic transfer switch is announced*

a rolling and wiping action. Compression springs provide required contact pressure and permit quick opening. Three and four pole switches are protected on all phases with relays.

## Speed Increasers Operate Pumps

FOR operating centrifugal pumps, high speed blowers, compressors, and for pipe line service, a new line of speed increasers is announced by Westinghouse Electric & Mfg. Co., East Pittsburgh. Standard gear ratios vary from 2:1 to 12:1, and these new units are available in ratings from 1-horsepower per 1000 revolutions per minute of the high speed shaft to more

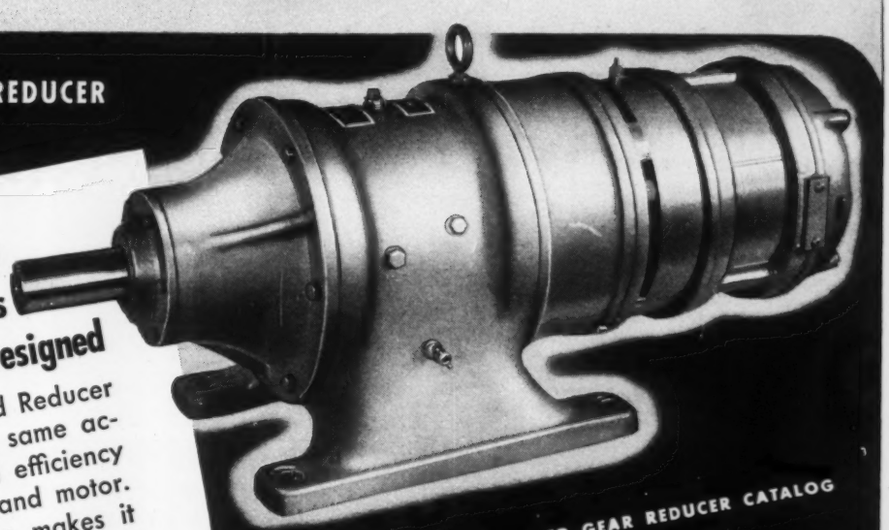


*Line of speed increasers is announced for operating centrifugal pumps, high speed blowers, compressors and other uses*

than 1800-horsepower per 1000 revolutions. These speed increasers can be supplied for either right or left hand assembly. Sleeve bearings have been designed to provide low unit pressures and assure permanent alignment with minimum friction loss. Lubrication is accomplished by a self-contained circulating oil system. Gears are spray-lubricated at the line of contact and all bearings are under pressure lubrication. Frames

# MOTORIZED SPEED REDUCERS...

MOTORIZED GEAR REDUCER

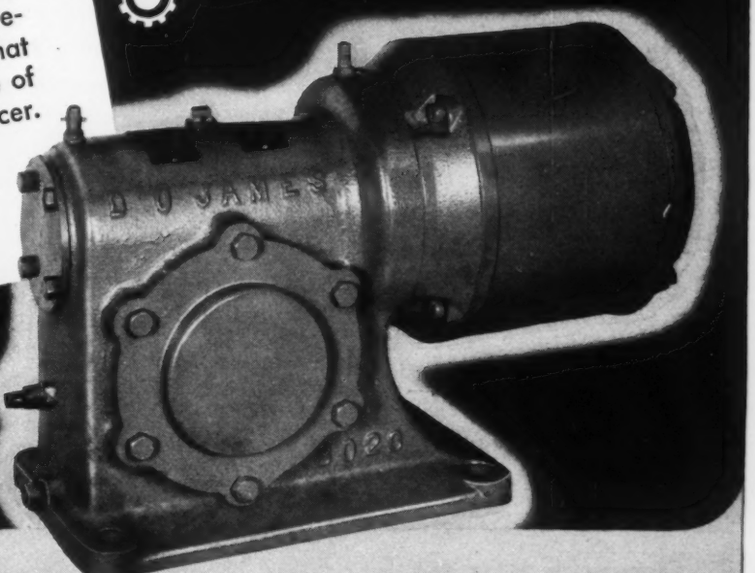


**Manufactured Carefully to Meet the Requirements of Service for Which it Is Designed**

The D.O.James Motorized Reducer is designed to have the same accessability, strength and efficiency as a separate reducer and motor. Its compact construction makes it applicable where space is limited • Over a half century of making all types of gears and gear reducers gives us an experience that is invaluable in the manufacture of the D.O.James Motorized Reducer.

**D. O. James Manufacturing Co.**
Established 1888
1120 W. Monroe Street Chicago, Ill.

WRITE FOR MOTORIZED GEAR REDUCER CATALOG



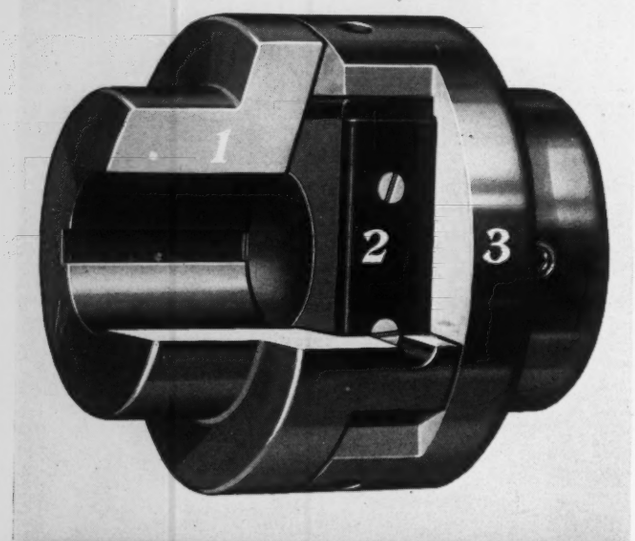

MOTORIZED WORM GEAR REDUCER

# D.O.JAMES

**OVER 50 YEARS MAKERS OF EVERY TYPE OF GEAR AND GEAR REDUCER**

"SEEMS LIKE THE SIMPLER THE EQUIPMENT—THE LESS HEADACHES AND MORE PRODUCTION WE GET!"

**Specify AMERICAN FLEXIBLE COUPLINGS FOR EQUIPMENT YOU DESIGN**




**ONLY 3 SIMPLE—RUGGED PARTS**

2 identical jaw flanges—1 floating center block

• American Flexible Couplings will help users of your equipment to get all the performance you designed into it.

Based on a new application of the proven Oldham Principle, these couplings provide complete flexibility that compensates for normal misalignment with exceedingly small power loss. No cramping or binding of bearings.

Maintenance is simplified—inexpensive and easily replaceable strips on floating center block absorb the wear. For complete information write for Catalog No. 361.

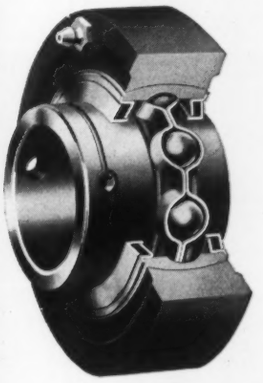
**AMERICAN FLEXIBLE COUPLING CO.**
Erie, Pennsylvania

**AMERICAN FLEXIBLE COUPLINGS** *provide complete flexibility without flexible materials*


are split horizontally to permit easy access to all internal parts.

## Bearing Cartridges Added to Line

SELF-ALIGNING ball bearing cartridge units have been added to the Sealmaster line of Stephens-Adamson Mfg. Co., Aurora, Ill. A centrifugal labyrinth seal effectively seals bearings from foreign materials and simultaneously retains lubricant. Misalignment of the shaft cannot interfere with the effectiveness



*Misalignment of shaft cannot interfere with effectiveness of seal on new ball bearing cartridge units*

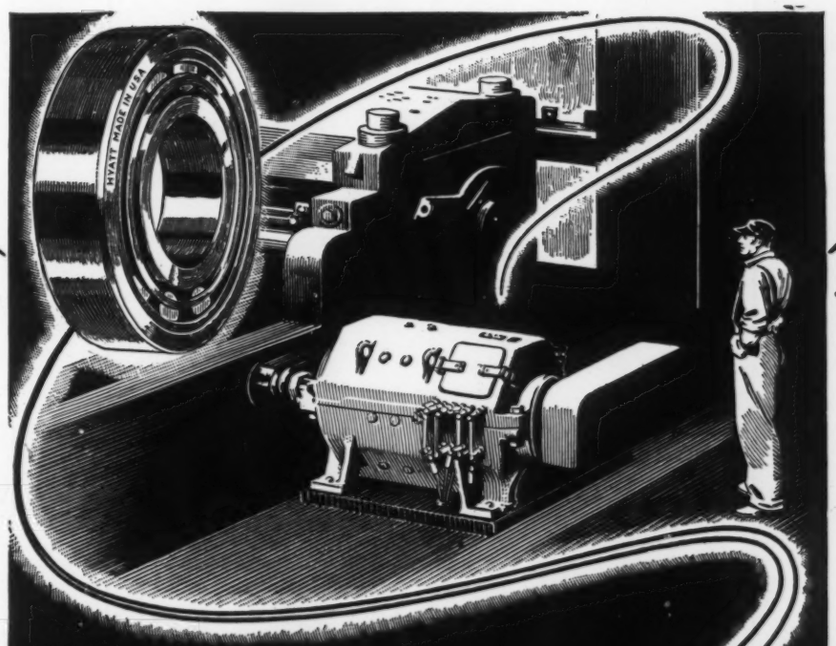
of the seal, for the bearing's outer race is ground on the radius and locked in the housing socket with a nipple permitting 2 to 4 degrees misalignment in any direction. Wear of felt is avoided because it is assembled without pressure.

## Develops Small Static Eliminator

TO COVER demand for a small static eliminator for electrically driven office machines, the Simco Co., 4929 York road, Philadelphia, has brought out a Tiny Midget static eliminator consisting of a power unit, 4 by 5 by 3 inches, and one 5/16-inch diameter

*Current output on small static eliminator is so small that any part of high voltage system may be touched without shock*

metal-encased static bar. The high voltage lead is brought out of the power unit and terminates at the female portion of an insulated connector. The bar cable terminates in the male portion. Voltage carried by this unit is extremely small and current output is




# HORSEPOWER and HORSE SENSE

## GO WITH HYATTS

### TO HOLD THE WHIP HAND

over horsepower . . . to keep it from balking or laying down on the job . . . to reduce its upkeep and prolong its useful life . . . builders of mechanical equipment harness it up with smooth-rolling Hyatt Roller Bearings. They know from experience that horsepower and horse sense go hand in hand with Hyatts to assure the users of their equipment freedom from bearing wear and care. For further details write to Hyatt Bearings Division, General Motors Sales Corporation, Harrison, New Jersey; Chicago, Pittsburgh, Detroit, and San Francisco.

# HYATT *Roller* BEARINGS

1915 to 1940 at HOWELL

The Same Ideal for a Quarter Century — "PERFECTION"

. . . 1940—HOWELL'S Silver Anniversary Year!

And today, just as in 1915 when the first HOWELL Motor was wound, every operation of hand and machine is directed toward one ideal: *"To produce the most nearly perfect electric motors."*

This desire to attain perfection still inspires everything done at HOWELL . . . the use of finest materials—unhurried craftsmanship—the most exacting of final tests.

*Yes, the hard way to build motors—but what a boon to motor users!*

Select HOWELL Motors, and you're certain of getting the last word in unfailing performance and low operating costs.

*We invite your next motor inquiry. Write for sales literature.*

Exacting Tests Such As These Insure that Every HOWELL Motor Measures Up

QUIETNESS TEST—*conducted in sound-proof laboratory — motor operating at full speed. Every HOWELL Motor is quiet-running—we make sure of that.*

PRECISION BALANCE TEST — *vibrometer check-up with motor operating at full speed, assuring perfect balance of rotor assembly and bearings.*

1915 · 1940 HOWELL MOTORS 25th Anniversary Year

HOWELL ELECTRIC MOTORS COMPANY
HOWELL, MICHIGAN
*Representatives In All Principal Cities*

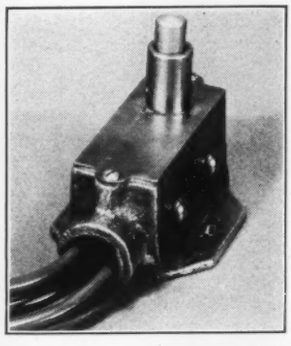

so small that any part of the high voltage system can be touched without receiving a shock.

## Controls Oil Combustion

CONTROLLING the atmospheric conditions in the heating chamber of oil-fired furnaces, the Air-Oil Ratiotrol is announced by North American Mfg. Co., 2910 East Seventy-fifth street, Cleveland. The Ratiotrol accurately proportions the flow of fuel oil and its combustion air by controlling pressures and making them dependent on each other. The air pressure alone becomes the dominant factor while the number of burners and their individual settings have no effect on the operation. Constant atmosphere is maintained despite fluctuation of oil or air pressure, varying rates of fuel input or manipulation of individual burners.

## Pressure Preset in Limit Switches

AN ADDITION to its line of limit switches is announced by Mu-Switch Corp., Canton, Mass. Operating pressure is preset at the factory at any value between 4 ounces and 3 pounds. Contacts are rated at 10 amperes on 110-volt alternating current and are operated by a plunger which has a pretravel of .004-inch and overtravel of 3/8-inch. Circuit arrangement includes single-pole, single-throw units, normally open or closed and single-pole, double-throw. The new assembly is sealed in pitch in a one-piece bronze casting and includes three designs.



*Operating pressure in limit switches is preset at factory, and contacts are operated by plunger*

## Flat End Shields on Motors

UNIMOUNT end shields with a flat surface to facilitate mounting of pumps and other directly driven equipment and for mounting magnetic brakes, are now available on motors made by U. S. Electrical Motors Inc., Los Angeles. They may be assembled on either end of the motor and can be used to mount a footless motor to a machine frame if desired. These end shields also may be secured unmachined, permitting the user to machine the mounting dimension to suit his particular unit. A number of standardized outside diameters, mounting machine fits and bolt circles are available.

(*Continued on Page* 80)

# SUSTAINED PRESSURE

## HELE-SHAW *Fluid Power* HAS IT!

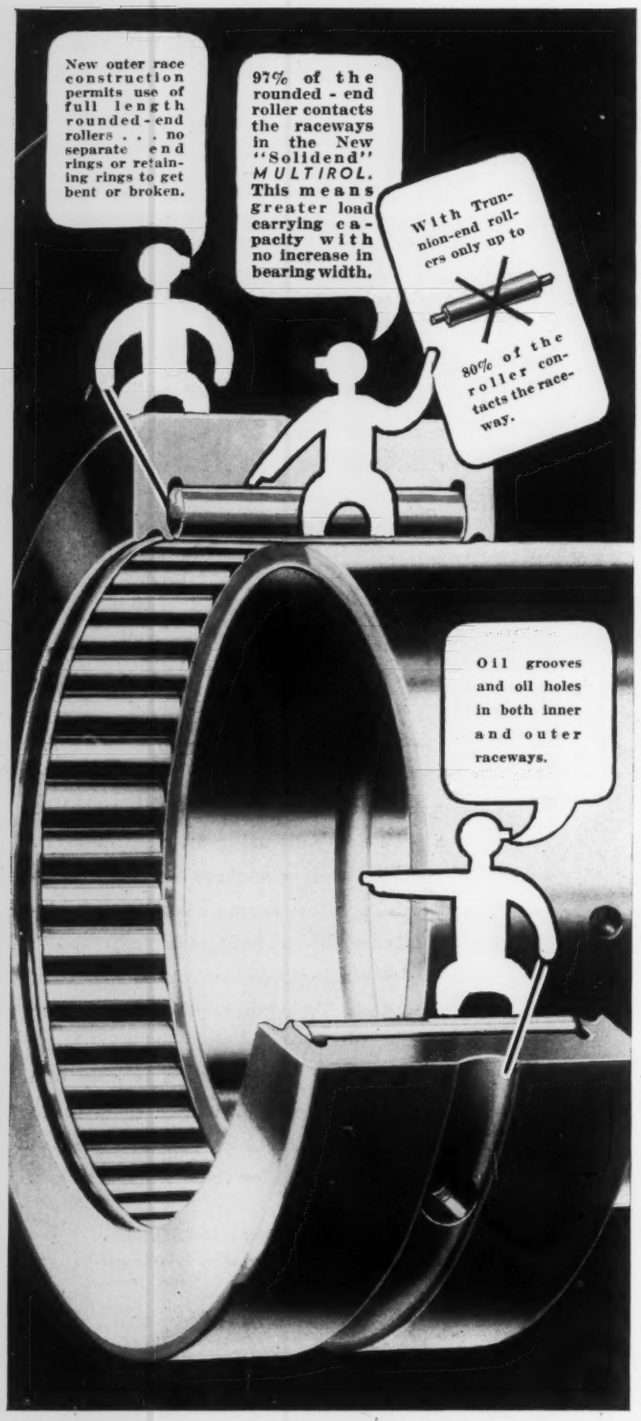
**The bagpipe player's reputation for sustaining pressure is strongly suggestive of the ability of a Hele-Shaw Pump to generate and sustain high pressures. The Hele-Shaw Pump is capable of developing pressures up to 3000 pounds per square inch (without using an accumulator). Furthermore, such pressures can be maintained with little loss through leakage or friction. Before you design, build or buy a hydraulic press or hydraulic plunger-operated machine, investigate Hele-Shaw Pumps and Fluid Power (oil under pressure for driving machines). The pressure sustaining feature is only one of many other practical, usable benefits to be gained. Ask us to show you how we can put Hele-Shaw Fluid Power to work for you.**

**Other A-E-CO Products: Lo-Hed Hoists, Taylor Stokers, Marine Deck Auxiliaries.**

**A-E-CO Hele-Shaw FLUID POWER**

## AMERICAN ENGINEERING COMPANY

2502 ARAMINGO AVENUE, PHILADELPHIA, PA.


New outer race construction permits use of full length rounded-end rollers . . . no separate end rings or retaining rings to get bent or broken.
97% of the rounded-end roller contacts the raceways in the New "Solidend" MULTIROL. This means greater load carrying capacity with no increase in bearing width.
With Trunnion-end rollers only up to
80% of the roller contacts the raceway.
Oil grooves and oil holes in both inner and outer raceways.

# McGILL'S New "Solidend" Multirol

With an entirely new type of race construction, the New "Solidend" *MULTIROL* utilizes full length rounded-end rollers, increasing greatly the load carrying capacity in comparison with bearings of the same width. Without end washers or retainer rings, the New "Solidend" *MULTIROL* is simple in construction, low in cost, and easy to install. Can be used either with or without inner raceway and is available in shaft sizes up to 5 inches. A minimum of clearance between end shoulders and inner raceway makes bearing self-sealing. Simplified construction means lower cost to you, and a bearing that is easier to install. Write for further details.

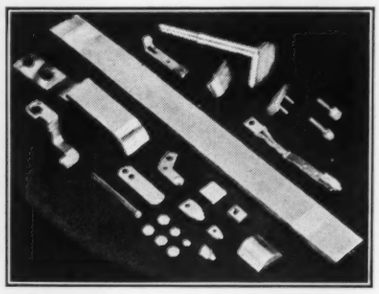
**McGILL MANUFACTURING CO.**

**1450 N. Lafayette Street VALPARAISO, INDIANA**


*(Continued from Page 78)*

## Powder Metal Contacts on Market

ELECTRICAL contacts, made of a nonferrous powdered metal composition known as Gibsiloy, are being marketed by the Gibson Electric Co., 585 Boulevard of the Allies, Pittsburgh. Hardnesses range up to 200 brinell for some grades of silver-nickel-tungsten. These contacts are free from galling and their high arc

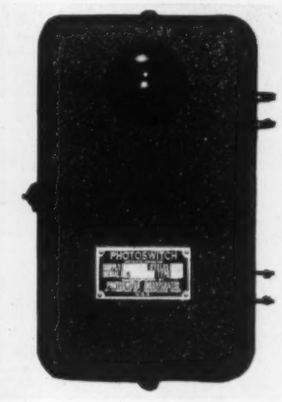


*Nonferrous powdered metal composition may be formed into a number of shapes of contacts*

resistance greatly reduces welding or sticking. Some of the many shapes into which Gibsiloy may be formed are shown in the illustration. Metals most commonly used include silver, nickel, cadmium, tungsten, molybdenum.

## Photoelectric Limit Switch

TO REDUCE maintenance on limit switches in heavier machines, Photoswitch Inc., 21 Chestnut street, Cambridge, Mass., announces an addition to its line of controls, the "electric eye" limit switch. Type A-14-B is supplied with the light source in a weather-




*Photoelectric limit switch, in two types, may operate with light source or from light given off by red hot metal*

proof housing suitable for installation in any location. Type A-20-C operates directly from the light given off by red hot metal of any shape. No light source is required.

## Finish Adheres to Plastic Surfaces

DEVELOPMENT of Kem Plastite enamel, specially formulated for finishing plastic materials and designed to provide thorough adhesion to the hard surface of plastics, is announced by the Sherwin-Williams Co., Cleveland. This finish withstands severe abrasion and impact without marring or chipping. Another finish known as Kem Bakolescent enamel is also on the market, and is characterized by the beauty,

# WHEN THE HURRICANE HIT US

# BELOW THE BOILERS

1

**"Get ready for a long shutdown, boys!"** I howled as the hurricane flood reached our boiler room. We couldn't start up proper, I thought, until that extra special motor on the ash-sluicer was dried out.

2

**Answering my buzz,** over came Joe Brown of the G-E Service Shop. He went over the motor. "I'm afraid she needs baking out." Then, "Let me use your phone." That was at 8 p.m.

3

**At 5 next morning up breezed two motorcycle cops** running interference for a big truck. Aboard was a motor just like our wet one.

THIS story is based on facts in our files—a typical example of how G-E service comes to the rescue—shoulders part of the burden that may suddenly be placed on the organizations of many machinery manufacturers in emergencies.

Do you sell machines in all parts of the United States? If so, you'll find it wise to equip them with G-E motors and control. This is so because General Electric maintains nationwide facilities to restore electrical machines to factory-new standards or to replace such machines promptly if necessary, at reasonable expense.

4

**Where'd you get it, Joe?** I asked. "They **did** have another one!" he replied. A special trip planned, and away she went last night. The cops escorted it the last 30 miles.

5

**Joe won the toss** to see who'd buy the cops cigars. Then we pitched in to work. What I'd thought was going to be a week's shutdown turned out to be less than 24 hours.

No matter where your customers are, they can draw on the service of the nearest of 80 sales offices, 28 warehouses, or 25 service shops.

With this national network of co-operation you don't have to worry about the electrical end of your machines. General Electric, Schenectady, N. Y.

**GENERAL ELECTRIC**

011-567

# IT PAYS
## to Build G-E Instruments into Your Machines

IT HAS PAID other manufacturers and it will pay you to specify G-E instruments on your machines. Our engineers will be glad to modify a standard instrument to meet your requirements. Or, if you have unusual problems, they will work out a new design.

Why not take advantage of the G-E facilities and make General Electric your

**Headquarters for Electrical Measurement**

430-62

**GENERAL ELECTRIC**


richness and depth of tone afforded by its opalescent particles. It can be baked without occurrence of unsightly flooding, and is likewise highly adhesive.

### Extrude Shapes of Cemented Carbide

CARBOLOY cemented carbide can now be produced in the form of tubing, spirals and round or shaped bars by means of an extrusion process, the Carboloy Co. Inc., Detroit, announces. Available in lengths up to 20 inches, within a diameter range of from .015 to ⅜-inch, these shapes were formerly limited to an extremely small size range and much of the shaping operation had to be performed manually. The new process eliminates most of the customary hand forming operations. A supplementary process bends Carboloy rods in various shapes. In the extrusion process, dry powder is mixed with a plasticizing medium.

## Engineering Dept. Equipment

### Line of Graph Paper Announced

A BROAD, comprehensive line of graph papers is announced by Eugene Dietzgen Co., Chicago. It includes "same division" and "different division" sheets; security price sheets; logarithmic and semilogarithmic sheets in varying divisions, size and weights; mathematical sheets in circular percentage, isometric, polar and triangular coordinates; time element sheets for periods from one day to five years. Paper is high grade rag content bond, printed in a special olive green ink.

### Portable Drawing Machine Announced

NO LARGER than a brief case, the Autodraft portable drawing machine is announced by Eugene Dietzgen Co., Chicago. The L-square-protractor mechanism is always held in true by a permanently attached semiuniversal arm which swings over the entire surface of the board. Angles from zero to 360 degrees may be set by loosening the plastic knob on the protractor-L-square. The entire mechanism is made of nonreflecting metal.

*Portable drawing machine has semiuniversal arm which swings over entire board*

# Powder Metallurgy

(Concluded from Page 43)

are being made which cost less and perform better than those produced otherwise. In the case of a gear for an automotive oil pump, *Fig.* 6, a saving of 33 per cent in cost is realized because a perfect gear can be made without machining. The former method machined a blank weighing .8 pound into a gear weighing .28 pound. The pressed gear weighs only .21 pound and is quieter, more accurate, longer lived. It is not claimed, of course, that powder metal at present would be suitable for large, heavy duty gears.

For resistance rings at the ends of rotors of squirrel cage motors, copper powder is being utilized. *Fig.* 7 shows such a rotor whose end rings are pressed on after the rotor bars are assembled in the stacks of core iron punchings. Considerable waste of copper was avoided because compression was limited to a depth of only ⅛-inch.

To reduce excessive abrasive wear on localized areas, cemented carbides are being applied. In the hydraulic oil well pump in *Fig.* 8, cemented carbide is used for the ball and valve seat inserts. Wear on these valves is extremely severe because the oil contains sand and water. In fact, this type of pump is said to have been impractical before this application was discovered.

### Applications Still Limited

Certain limitations at present apply to most powder metallurgical applications, however. The high pressure required to form uniform briquettes establishes definite dimensions on the parts. At the same time, it requires large and expensive presses along with strong, well-constructed dies. Unless parts are being made in quantity, the cost may be excessive.

A more general factor tending to limit progress in the field is the need for more studies of the fundamentals involved in the manipulation and manufacture of powders, the physical and chemical properties of compacts, and the mechanics of compression and annealing. Why, for instance, do compresses made from powders show such exceptional strength? In some instances fusion results, which would tend to explain the question, but in many other examples no fusion occurs, yet the bond is remarkably strong. As these problems are solved, as research in general expands, and as the cost of powders and machines goes down, more uses for powder metals will arise in addition to the many successful ones extant.

Appreciation is extended by the editors to the following companies for their co-operation in assembling material and illustrations for this article: Amplex division, Chrysler Corp.; Bound Brook Oil-less Bearing Co. (*Figs.* 3 and 4); Carboloy Co. Inc. (*Fig.* 8); Charles Hardy Inc. (*Fig.* 7); Johnson Bronze Co.; Metals Disintegrating Co. (*Fig.* 2); Moraine Products division, General Motors Corp. (*Figs.* 2, 5 and 6); Powder Metallurgy Inc. (*Fig.* 1).

The ROTATING-CAM SWITCH Designed for the Machine Designer

FOR USE AS
Full-voltage Reversing Switch for Squirrel-cage Motors
Two-speed Control for Single-winding A-c Motors
Two-speed Control for Separate-winding A-c Motors
Three- or Four-speed Control With One Reverse Speed

MACHINE designers will especially appreciate this switch. With the flange, which is available for flush mounting of the standard switch, all that the designer needs to provide for completely *built-in* control is an opening and drilling in the face of the machine.

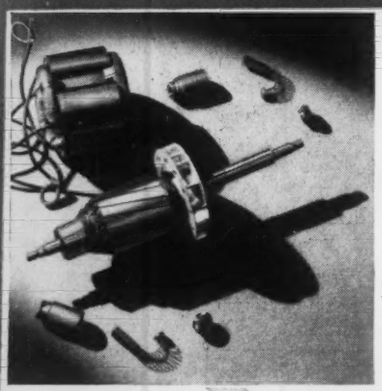
The safety advantages of this switch are obvious. Since it is completely enclosed in a steel housing, even when mounted entirely within a machine, the operator is safeguarded, and the possibility of failure due to accumulations of dirt on the switch is minimized.

Another advantage of this universally adaptable switch is the fact that a stock of only a few standard models makes it easy to meet almost any machine requirement—by the use of the flush-mounting flanges and the five types of operating knobs or levers.

We shall be glad to send you complete descriptive information, with dimensions and application data. Write for Publication GEA-2230. General Electric, Schenectady, N. Y.

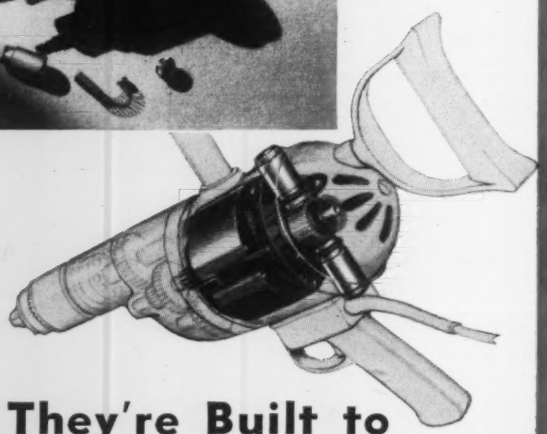
GENERAL ELECTRIC
080-99

MORE THAN JUST MOTOR PARTS



*Left*—Typical G-E motor parts

*Below*—A device using such parts



They're Built to Match Your Devices

When you buy G-E motor parts, you get, in addition to the parts, engineering service that means longer-lived devices and satisfied users. G-E engineers have successfully applied high-speed motor parts to such devices as drills, sanders, routers, shapers, reamers, mixers, hammers, saws, and valve seaters. These specialists will be glad to work with you and give you the benefit of their many years of experience in selecting torques, speeds, gear trains, mounting arrangements, and ventilating systems. They may also be able to show you how to save on materials, machining, and assembling.

General Electric offers a complete line of universal series-motor parts in ratings from 1/100 to 1 1/3 hp at speeds from 5,000 to 10,000 rpm, for operation on either alternating or direct current up to 250 volts. For additional information, ask the nearest G-E sales office for GEA-1942, or write General Electric, Schenectady, New York.

070-194

GENERAL ELECTRIC


# Topics

(*Concluded from Page* 32)

the process gives a finish sufficiently black to escape color refraction under an intense beam of light in a dark room. Aluminum may be plated directly with only a cleaning in an alkaline bath. The finish is also applicable to bases of zinc, cadmium, tin, nickel, steel and iron. It consists of 45 per cent molybdenum, 10 per cent nickel, balance mainly oxygen.

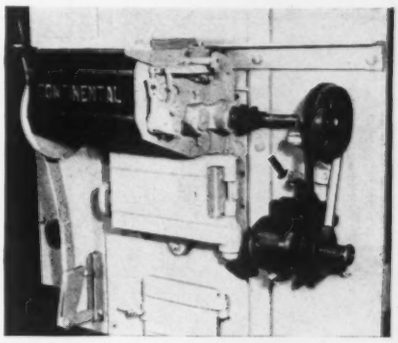
♦

PERIODS of international unrest always lead Americans to wonder about the economic consequences if certain essential imports of industrial materials should be cut off from this country. Even persons not directly concerned have probably speculated on the result of hostile seizure of the East Indies or Liberia, since most of our raw rubber would be intercepted. Another vital imported material is manganese. Vast deposits of ore lie within the United States—but until very recently they were economically useless because of their low grade. Russia and Cuba have supplied the best ore. In 1930 research was started which has culminated in a successful process for concentration of low grade ores. Self-sufficiency for this country is seen because it is now possible to convert low grade ore into high grade manganese sinter superior for ferromanganese to the best Russian ore. And the United States has more than enough manganese to convert all our known iron ore into steel.

♦

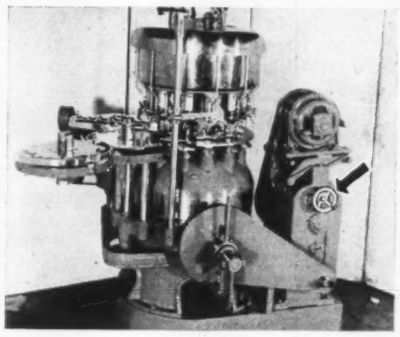
USUALLY it is assumed that acid pickling will produce only deleterious effects in steel with regard to fatigue properties, because of the pitted surface resulting from the acid attack and the harmful effects caused by hydrogen embrittlement. A recent paper by G. L. Kehl and C. M. Offenhauer presented before the A. S. M. discusses investigations of acid pickling. It points out that while the fatigue limit cannot be raised by pickling above the "as received" condition, the choice of proper pickling temperatures, acid concentration of the bath, and type of inhibitors used will cause the fatigue limit to approach the "as received point" point. Pickling under "standard" conditions—twelve minutes in a 10 per cent by weight aqueous solution of sulphuric acid at a temperature of 149 degrees Fahr.—reduces the fatigue limit of the material by about two per cent. Addition of certain inhibitors in the pickling bath, Di-ortho-tolythiourea and Acitrol 100, minimizes the formation of surface notches and prevents a decrease in fatigue properties. Between certain limits, increase in temperature of the pickling bath and longer pickling times result in decreased fatigue properties.

# What's New *In Speed Control Applications*



## ON INDUSTRIAL STOKER

Rate of coal feed to this furnace is regulated, to maintain uniform steam pressure, by means of a REEVES Motor Pulley which varies stoker speed at will of the operator, and holds the speed without fluctuation until a new setting is desired.

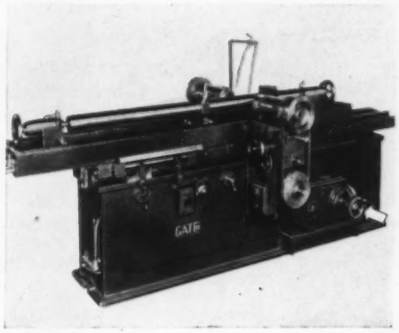


## ON FILLING MACHINE

To provide adjustability of operating speed for different sizes of containers, and different viscosities of liquids, this specially built filling machine is equipped with a vertically mounted REEVES Variable Speed Transmission. Simply by turning the REEVES handwheel, the operator makes any change-over required, and without loss of production time. REEVES accuracy and positiveness insure the filling of each jar to the proper height, with no waste of product.

## ON SPLINE MILL

For precision in operating speeds, and extreme flexibility to meet the requirements of widely varying sizes of keyways and shafts on which splines are cut, this Spline Mill is equipped with a REEVES Motodrive. The mill has a capacity of 96 inches between centers and handles diameters up to 5½ inches. Cutter diameters are $\frac{3}{16}$-inch to 1-inch, and spindle speed ranges from 230 to 600 r.p.m. The flexibility provided by REEVES has resulted in many sales in competition with other machines having gear set speed changing methods, says the manufacturer.



## REEVES ADVANTAGES

*Positive transmission* of power at any speed and under varying loads; no slippage or fluctuation.

*High efficiency* . . . negligible loss of power transmitted.

*Simplicity of design* and operating principle . . . few moving and wearing parts; long life and trouble-free service.

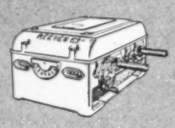
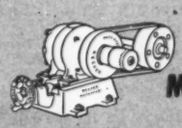
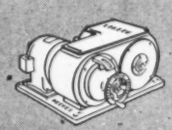
*Wide range* of designs, sizes, speed ratios, controls . . . insuring the correct application for your individual needs.

*A nation-wide* engineering organization at your service, without obligation.

May we tell you more about REEVES Speed Control and how easily it can be applied to the machines you build? Send for 122-page Catalog G-397, which describes and illustrates REEVES units and their use as standard equipment by builders of over 1300 different makes of machines.

**REEVES PULLEY COMPANY**
*Dept.* **H, Columbus, Indiana**

# Reeves *Speed Control*

| | |
|---|---|
|  **Variable Speed TRANSMISSION** | Based on principle of V-belt driving between two pairs of adjustable cone-shaped discs. Provides infinite speed adjustability over wide range and for heavy duty service. Accurate and positive at all speeds. Modern open and enclosed designs, vertical, horizontal. Available in fourteen sizes—fractional to 75 h.p. capacities. Speed variations in ratios from 2:1 to 16:1 inclusive. |
|  **Vari-Speed MOTOR PULLEY** | Simplified development of the Variable Speed Transmission. Mounts on standard shaft of any constant speed motor. Forms direct drive from motor to machine. Sliding motor base is moved forward or back by handwheel for speed changes. For light horse power requirements up to and including 15 h.p. and not greater than 3:1 ratio of speed range. |
|  **Vari-Speed MOTODRIVE** | Combines in one compact, self-contained enclosure, constant speed motor, REEVES speed varying mechanism and reduction gears (where required). Any make standard foot-type constant speed (ball-bearing) motor may be used. Available in space-saving horizontal and vertical types—¼ to 10 h.p. capacities. Speed variations in ratios from 2:1 to 6:1 inclusive. |

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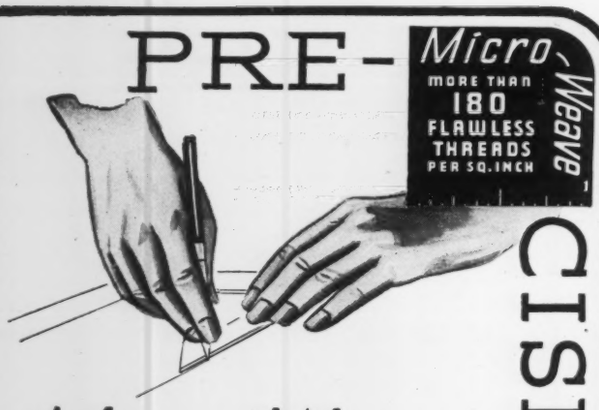


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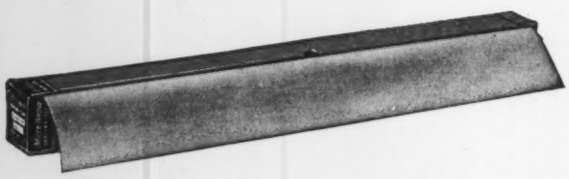

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# Meetings and Expositions

**Jan. 5-13—**
**National Motor Boat Show** to be held at Grand Central Palace, New York. Additional information may be obtained by writing headquarters.

**Jan. 9-11—**
**Institute of Scrap Iron and Steel.** Annual meeting to be held at William Penn hotel, Pittsburgh. E. C. Barringer, 11 West Forty-second street, New York, is executive secretary.

**Jan. 10—**
**American Washer & Ironer Manufacturers association.** Annual meeting to be held at Chicago. Further information may be obtained from J. R. Bohnen, 80 East Jackson boulevard, Chicago, secretary.

**Jan. 10—**
**National Aeronautic Association of the U. S. A.** Annual meeting to be held at New Orleans. Additional information may be obtained by writing William R. Enyart, Ambassador Hotel, New York, secretary.

**Jan. 15-17—**
**National Air Conditioning association.** First annual convention to be held at Chicago. Information may be obtained from John H. Keller, Mechanical Heat and Cold Inc., Detroit.

**Jan. 15-19—**
**Society of Automotive Engineers Inc.** Annual meeting to be held at the Book-Cadillac hotel, Detroit. John A. C. Warner, 29 West Thirty-ninth street, New York, is secretary and general manager.

**Jan. 17-19—**
**American Society of Refrigerating Engineers.** Thirty-fifth annual meeting to be held at Blackstone hotel, Chicago. David L. Fiske, 37 West Thirty-ninth street, New York, is secretary.

**Jan. 22-26—**
**Canning Machinery and Supplies association.** Annual meeting and exhibition to be held at the Stevens hotel, Chicago. S. G. Gorsline, Box 430, Battle Creek, Mich., is secretary.

**Jan. 22-26—**
**National Warm Air Heating and Air Conditioning association.** Meeting and air conditioning exposition to be held at Lakeside Hall, Cleveland. Additional information may be received from Charles F. Roth, International Exposition Co., Grand Central Palace, New York.

**Jan. 22-26—**
**American Society of Heating and Ventilating Engineers.** Sixth International Heating and Ventilating exposition and forty-sixth annual meeting of the society to be held at Lakeside Hall, Cleveland. Exposition will be under direction of Charles F. Roth, Manager, International Exposition Co., Grand Central Palace, New York.

**Jan. 22-26—**
**American Institute of Electrical Engineers.** Winter convention to be held in New York. Additional information may be obtained from H. H. Henline, 33 West Thirty-ninth street, New York, secretary.

**Jan. 29-Feb. 2—**
**American Road Builders association.** Annual meeting and exhibit to be held at the International Amphitheater, Chicago. Charles M. Upham, 952 National Press building, Washington, is secretary.

**March 6-9—**
**Industrial Tools & Equipment exhibition** to be held at Bridgeport, Conn. Sponsored by Bridgeport Tool Engineers association, State Armory, 1494 Main street, Bridgeport, Conn. Further information may be obtained from R. T. Phipps, 271 Grovers avenue, Bridgeport, Conn.

**March 11-14—**
**American Society of Bakery Engineers.** Annual meeting to be held at Edgewater Beach hotel, Chicago. Victor E. Marx, 1541 Birchwood avenue, Chicago, is secretary.

# Designing Release Latches

(*Continued from Page* 55)

distance may be considered the measure of shockproofness. Zero friction is assumed. *Fig.* 6 shows the three classes under the given conditions with their respective force diagrams immediately below them. Assuming force at *A* equal to 100 pounds, the Class 1 latch at (a) carries load of 40 pounds. Since there is no locking torque around pin *G*, and friction is absent, the tripping force is zero. Taking the same latch-load on the Class 2 latch at (c), we obtain from the diagram a value of 5 pounds for tripping. Again using the same value for the Class 3 latch, the value of 2.5 pounds is obtained for tripping. Under these conditions of equal shockproofness, the Class 1 latch has the least tripping force, the Class 3 the next larger, and the Class 2 the largest. During the unlatching process, lever *B* is turned clockwise and the energy obtained from *J* closes the mechanism very slightly in addition to its opening function. This condition is hazardous, as an unexpected rise in the resistance of *B* may stall *J* and keep the latch locked. The latter latch is particularly vulnerable for any irregularity in the surface *L*, due to wear for example, may cause the latch to stick and fail to operate.

### Friction Must Be Considered

Friction must be considered in determining the functioning of a practical latch. The rolling friction between hardened surfaces is small and may be neglected. Sliding friction, however, has been found to approach 25 per cent which will be used in all analyses. It is understood that the result of the friction study fixes a limit within which the latch must function properly. The other limit is zero friction which may be approached or even obtained under some conditions of lubrication or vibration. *Fig.* 7 illustrates the three classes of latches having the same proportions as those of *Fig.* 6, but analyzed with friction. They must operate satisfactorily under wide range of friction limits and inaccuracies of wear and manufacture.

In the Class 1 latch of *Fig.* 7(a), the pins are shown with friction circles, the force *H* being tangent to the friction circle of *F* and passing through the point of contact between the roller and prop. Since the pivoted lever does not move during the unlatching process, friction at its pin need not be considered. The combined vector diagram gives 29 pounds for latch load and 5.5 pounds for tripping. *Fig.* 7(b) shows the Class 2 latch with all pins analyzed for friction, since all parts move during unlatching. Due to this, the latch load is larger, which eventually means a larger tripping force. The diagram indicates 40 pounds for the latch load and 11 pounds for tripping. In the Class 3 latch of *Fig.* 7(c), the load is the resultant of the vertical support acting on lever B and a horizontal


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force numerically equal to 25 per cent of the vertical load. From the corresponding force diagram, load and tripping force are 42 and 14 pounds, respectively.

A study of the tripping forces indicates that a latch is a force-reducing device, since the tripping force is always smaller than the loading force. It is possible then, to change the proportions so that instead of a small locking torque there is a small tripping torque for use as part of a linkage to obtain mechanical advantage. This does not apply to the Class 1 latch which has no locking torque and therefore cannot have any tripping torque. *Fig.* 8 illustrates the use of the latches as force-reduction units. In (a) the toggle is so arranged that the line $H$ is tangent to the 25 per cent friction circles so that the value of the resultant $R$ is zero although the pins have an ostensible offset. To obtain a positive value for $R$, the nominal offset must be increased as shown in (b) so that line $H$, extended, falls definitely to the left of the friction circle. In *Figs.* 8(c) and 8(d) are two forms of the Class 3 latch used as force-reduction units. To obtain the proper direction of line $H$ the surface $L$ must be corsembly fitting operation.

The use of the toggle as a reduction unit is shown in *Fig.* 9(a) where the force of the spring is reduced by links before the latch is applied. Trip coil first releases the latch and then applies force against $E$ if the toggle tends to stick. In contrast to this construction is shown the double latch *Fig.* 9(b) where there is a Class 3 latch superimposed on a Class 2 latch both in the locked position, in the hope that the combination will be more shockproof than either used alone. This is an expensive design and probably not as reliable as the Class 1 latch.

### Double Magnetic Force Needed

The force analysis of the Class 4 latch is simple and need not be explained in detail. Referring to *Fig.* 5 the available magnetic force at the armature should be about twice as much as is really needed to oppose the torque of the spring load in order to obtain adequate shockproofness. This is necessary as the magnetic force drops very rapidly as the armature moves away from the pole pieces, a vibrating movement sure to occur during the operation of the mechanism. The loading force has for simplicity been shown as a spring. Where a mechanical latch is used, the variable loading is simply reflected in a similarly varying tripping resistance and, as long as the maximum tripping force is not exceeded, the apparatus will function. Shock loads have no effect on the action. If the magnetic latch were used directly connected with the linkage, the ratio of magnetic to loading forces would have to be 2 to 1, taking the shock loads as a base. For normal loads, this ratio would therefore be much larger so that more flux would have to be moved and the great speed advantage of the design lost. To retain this

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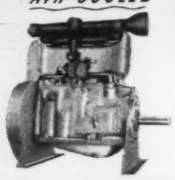

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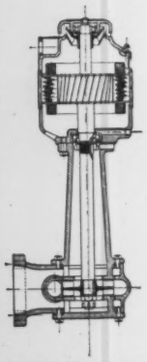

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feature and obtain stability, it is customary to load the magnetic latch with a spring and then to use it to apply tripping force to a mechanical latch having satisfactory shock resistance. In *Fig.* 10, the magnetic latch is loaded by a spring; a Class 1 latch is loaded by mechanism at *D* and released by impact of the magnetic-latch lever when the coil is energized. *E* is a cam driven by the mechanism to reset the latch.

Another method of obtaining trip force, especially in smaller mechanisms, is by thermal release. The forces generally are small and shock is nonexistent so that the Class 3 latch is satisfactory. *Fig.* 11 shows two variations, in the first of which, (a), a bimetal strip is heated by a resistance coil and bends to the left to remove its support from the lever. In the second, (b), the bimetal strip is part of the current path and the heating, by its resistance, causes flexing to trip.

In describing the performance characteristics of the latches, some mention was made of practical considerations. In the Class 1 latch, the important surfaces of the roller and the prop are circular and can be produced economically. Location of pivot centers does not materially affect the locking properties, so that small variations are not of critical importance. In the Class 2 latch, the amount of overcenter is a major consideration and is often made adjustable. The main toggle parts are subject to sliding friction which, in conjunction with the changes due to hammering of the toggle stop, makes the latch change in service. Of the mechanical latches, the Class 3 is the most sensitive to manufacturing variations.

**Latch Evaluations**

| Performance | Class 1 | Class 2 | Class 3 | Class 4 + 1 |
|---|---|---|---|---|
| Reliability | 3 | 2 | 1 | 2 |
| Shockproofness | 4 | 2 | 1 | 3 |
| Sensitivity | 2 | 1 | 3 | 4 |
| Speed | 2 | 1 | 2 | 4 |
| Practical Considerations | | | | |
| East of manufacture | 4 | 3 | 1 | 2 |
| Wear | 3 | 2 | 1 | 3 |
| Need for adjustment | 4 | 2 | 1 | 3 |
| Cost advantage | 3 | 4 | 2 | 1 |
| Composite rating | 25 | 17 | 12 | 22 |

If ordinal values are assigned to the various characteristics, with the greater number of points for the higher quality, the ranking is shown in the table. There is no attempt in this tabulation to weigh the comparative importance of these factors. In smaller mechanisms, where all forces are low, shock forces may be of a magnitude which make the use of a Class 3 latch satisfactory. In such mechanisms, the need for great reduction of forces may likewise be unnecessary and wear negligible. As the size of mechanism increases, both the performance and construction considerations become more important, and the use of the Class 1 latch is indicated. Here again, other considerations, such as extreme speed, may be of paramount importance, in which case it may be necessary to use the Class 1 latch for mechanical reasons in combination with Class 4 to supply the tripping force.

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# MANUFACTURERS' *publications*

ALLOYS (BRONZE)—A new data book has been compiled by Lumen Bearing Co., Buffalo, N. Y., to supplement its hand book for engineers and designers. The physical and metallurgical properties of the latest nonferrous alloys developed by Lumen are discussed and listed. Illustrations, including photomicrographs, are plentiful.

ALLOYS (NONFERROUS)—A comprehensive bulletin has been published by P. R. Mallory & Co. Inc., Indianapolis, discussing its nonferrous alloys. Physical and electrical properties of the various Mallory metals are described in detail and are listed in handy charts.

BEARINGS (ROLLER)—"Face lifting" operations on Bower roller bearings are discussed in an illustrated pamphlet just issued by Bower Roller Bearing Co., 3040 Hart avenue, Detroit. This treatment is called micro-honing and markedly improves the surface finish of bearing cups and cones, resulting in better lubrication and elimination of a "run-in" period.

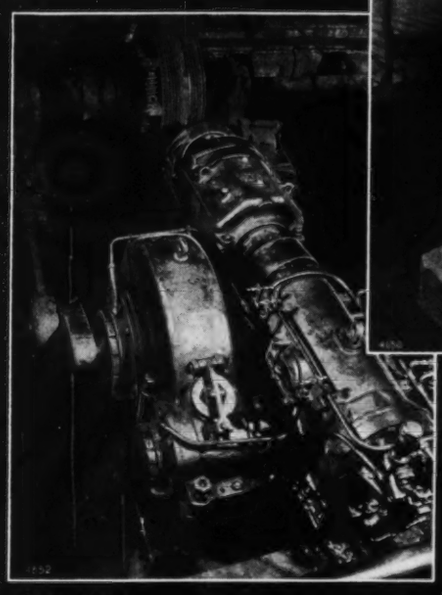
BI-METAL (THERMOSTATIC)—A general discussion on properties, applications, sizes and types of thermostatic bi-metals is given in a booklet issued by Dole Valve Co., 1901 Carroll avenue, Chicago. Two dissimilar metals, of low and high coefficients of expansion, are permanently bonded to form a compact bar or strip. Charts are included showing deflection and force developed per degree Fahr. change for various bi-metals.

CABLES—Cable Digest, a "condensed guide to aid in the selection of insulated cable for low-voltage power circuits," has been published by General Electric Co., Schenectady. It gives a summary of the various types and applications of cable, presents details of types, including prices, tells how to select conductor sizes.

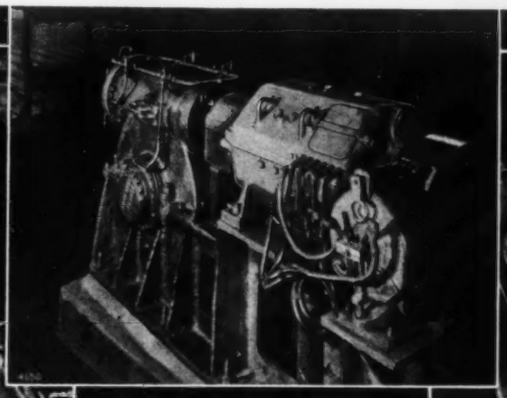
CONTACTS—Silver is used only on the surface of the base metal-backed contacts described by P. R. Mallory & Co. Inc., Indianapolis, in a bulletin just issued. The silver is permanently bonded to a suitable base metal—steel, bronze, nickel or monel. The booklet lists the possible combinations of facing and backing materials and describes the shapes and types of contacts available.

CONTROLS (ELECTRICAL)—General Electric Co., Schenectady, has issued the following bulletins describing electrical controls: GEA-1811B, plunger type relays; GEA-3248, new magnetic starter, type CR4052; GEA-3250, small magnetic starter; GEA-3259, magnetic contactors; GEA-3339, time switches.

CONTROLS (ELECTRICAL)—Catalog E has been



Bloom throw-over transfer drive; incorporating De Laval worm gear set.



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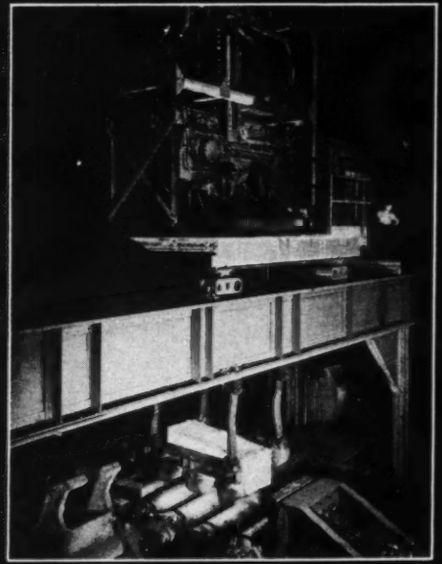

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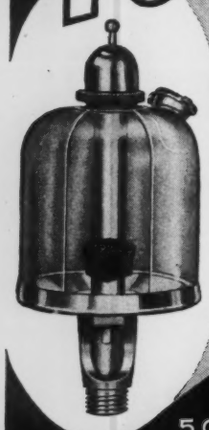

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TRICO FUSE MFG. CO. Milwaukee, Wis.

published by Struthers Dunn Inc., 1315 Cherry street, Philadelphia, describing and illustrating its line of relays, timing devices and thermostats. The book's 32 pages contain many new parts, new prices, and miscellaneous information.

CONTROLS (PNEUMATIC)—Uses and advantages of T-J pneumatic remote control systems are explained in bulletin number RC-4, issued by Tomkins-Johnson Co., Jackson, Mich. Profusely illustrated, the bulletin also shows application views and installation diagrams.

ELECTRIC EQUIPMENT—Accessories and equipment of all kinds for the radio and electrical industries are described, illustrated and priced in a new catalog published by American Phenolic Corp., 1250 Van Buren street, Chicago.

ELECTRICAL EQUIPMENT—Designed to help the user of electrical apparatus in selecting the right equipment for a motor or lighting circuit, a 59-page "Quick Selector" catalog has been published by Westinghouse Electric & Mfg. Co., East Pittsburgh. All sections are profusely illustrated and there are four pages of general application data.

FASTENINGS—Publication of a new stock list, No. 55-C, is announced by the Wrought Washer Mfg. Co., Milwaukee. Thousands of washer specifications in various materials are given, and those permanently kept in stock are so designated.

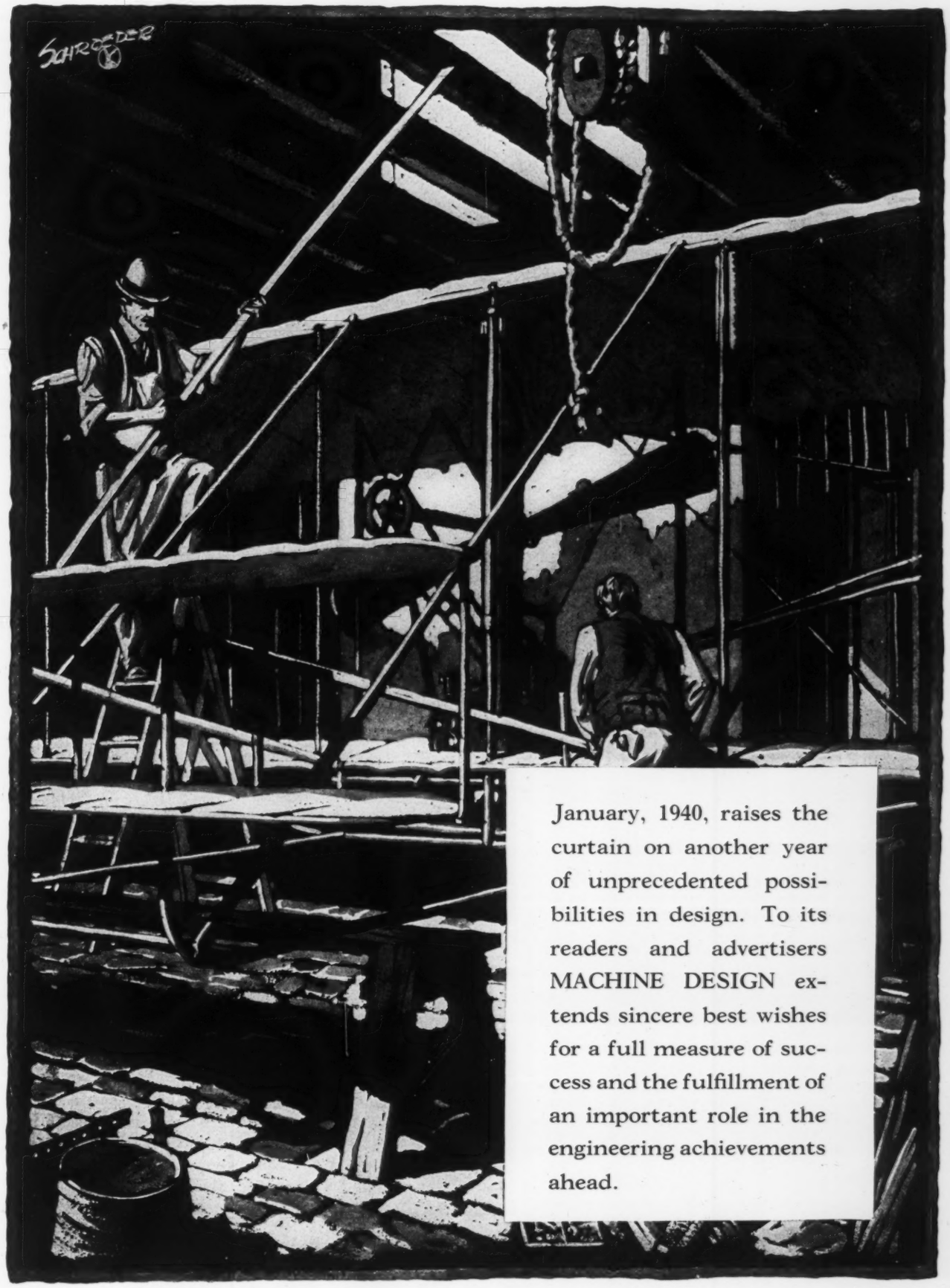
GEARS—Catalog No. 39 published by Illinois Gear & Machine Co., 210 North Natchez avenue, Chicago, gives price lists on all popular types of the company's cut gears. Particularly helpful is complete engineering data on the design and computing of power transmission capacity of gearing.

INSTRUMENTS—The Strobomeca, an instrument for measuring high and medium cyclic speeds from a distance without contact with moving objects, is described in a new illustrated bulletin issued by Boulin Instrument Corp., 65 Madison avenue, New York. Design of the instrument and its applications are explained fully.

INSTRUMENTS—Twenty-four page catalog No. 1125C has been issued by C. J. Tagliabue Mfg. Co., Brooklyn, N. Y., describing its complete line of industrial thermometers. Illustrations show the various forms, types and connections for many industrial applications. Other miscellaneous thermometers are discussed.

LUBRICATION EQUIPMENT—Bulletin J has been issued by Bijur Lubricating Corp., Long Island City, N. Y., discussing automatic lubrication of machinery. Stress is placed on the desirability of building centralized systems into original machines. A brief explanation is given of the equipment included.

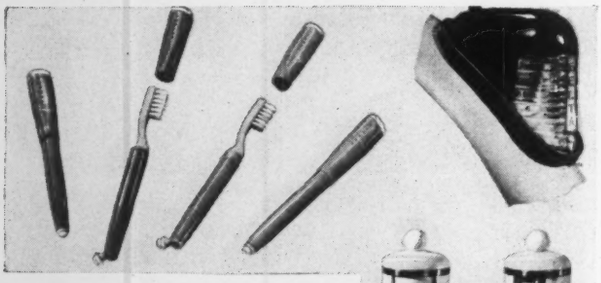
METALS—Cambridge Wire Cloth Co., Cambridge, Md., has issued a comprehensive bulletin, No. 76, containing general information on properties and applications of various metals and alloys, particularly as

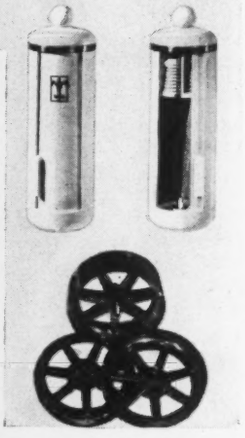


January, 1940, raises the curtain on another year of unprecedented possibilities in design. To its readers and advertisers MACHINE DESIGN extends sincere best wishes for a full measure of success and the fulfillment of an important role in the engineering achievements ahead.

*Great Moments in Machine Design—Wright Brothers and Their Airplane*

# 4 AWARD WINNERS





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**Top Award in the Novelty Group** Denta-Kit Tooth Brush molded of Tenite for Violette, Inc., Chicago, Illinois.

**Top Award in the Transportation Group,** the Bicycle Guardlite molded of Tenite for Delta Electric Company, Marion, Indiana.

**Honorable Mention in the Household Group,** Saniway Tooth Brush Sterilizer molded of Plaskon for Practical Products, Inc., Indianapolis, Indiana.

**Honorable Mention in the Industrial Group,** Cardineer Rotary File Wheel molded of Durez for Diebold Safe and Lock Company, Canton, Ohio.

**These awards speak for themselves as evidence of our consistent ability as Custom Molders of all types of plastic materials.**

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concerns their use in woven wire cloth, wire screens, wire products, and spiral woven wire conveyor belts. A feature is an extensive chart listing resistance to chemical attack of five grades of stainless steel.

METALS (BONDED) — American Nickeloid Co., Peru, Ill., has issued an illustrated folder discussing applications of American bonded metals to various machines. Photographs show clearly the results obtained with these metals.

MOTORS—High speed synchronous motors in the 7500 series, type TS, 3-phase, and type QS, 2-phase, are described and illustrated in leaflet GEA-246F, issued by General Electric Co., Schenectady. Rotors and stators are discussed separately and covered piece by piece.

MOTORS—A new leaflet, F-8492 issued by Westinghouse Electric & Mfg. Co., East Pittsburgh, discusses business machine motors for light duty applications.

MOTOR BASES—American Pulley Co., 4200 Wissahickon avenue, Philadelphia, has issued catalog MB38A, describing its tension control motor base which utilizes a motor's reaction torque and tends to make the frame of the motor turn in a direction opposite to the rotation of the motor pulley. The motor is placed in a cradle that is free to move through a limited arc and this force is harnessed. Effects of gravity are minimized and at no load the drive operates with relatively low belt tension.

PACKING (RINGS)—Carbon, graphite and metal-graphite seal and packing rings are described and illustrated in a new booklet in color issued by National Carbon Co. Inc., Cleveland. Thorough discussion is presented on application of each of the various types.

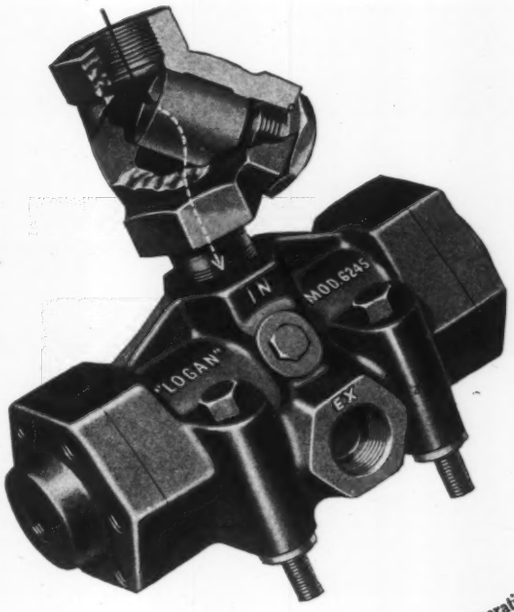
PIPE—An attractive two-color, 44-page catalog "Toncan Iron Pipe for Tough Service" has been issued by Republic Steel Corp., Cleveland, telling the story of Toncan copper-molybdenum iron pipe. It includes information on corrosion resistance, physical properties, sizes and weights.

PUMPS—John S. Barnes Corp., Rockford, Ill., has published two new pamphlets, descriptive respectively of gear pumps in the PA-20 series and of piston pumps in the PA-14, 16, 17 and 18 series. Design details are clearly presented, along with cutaway views. Useful performance data is included.

SPEED REDUCERS — Construction, speeds, and horsepower ratings of Adams MultiSpeed reducers are covered in catalog No. 201 published by The Adams Co., Dubuque, Iowa. Applications to a radial drill and wire drawing machine are illustrated.

SPEED REDUCERS—Catalog 7838 has been published by Stephens-Adamson Mfg. Co., Aurora, Ill., covering its Saco speed reducers. In color, the catalog lists advantages of the reducers, gives dimensions, and shows photographs of installations.

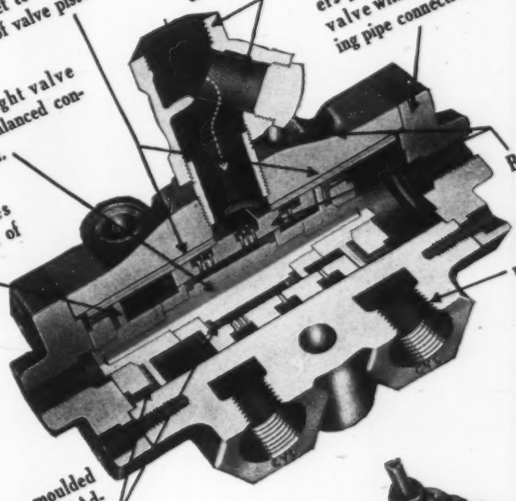
SPEED REDUCERS—Covering a wide range of sizes with many ratios, single, double and triple reduction



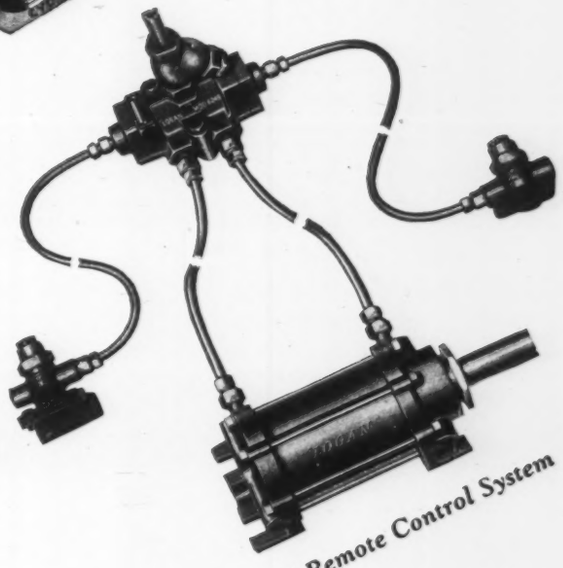

# POSITIVE ACTION MASTER CONTROL VALVE

## MODEL 6245 AIR OPERATED

"LOGAN"

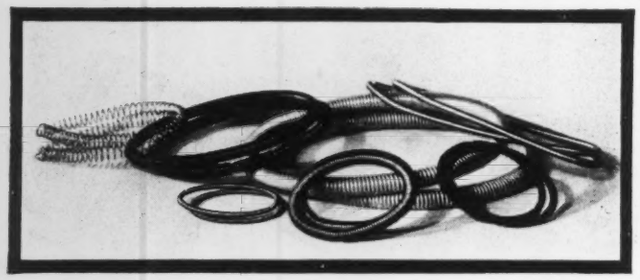

Air inlet to operating ends of valve piston.
Built in strainer furnished with valve. Easily removed for cleaning.
Removable end covers permit servicing valve without breaking pipe connections.
Light weight valve piston, Balanced construction.
Bronze liner and body. Corrosion resistant materials throughout.
Large area insures positive movement of valve piston.
Furnished in ¼" to 1¼" pipe sizes inclusive. Operating pressure 30 to 150 lbs.
Composition moulded cup packings, Self Adjusted by air.

The operation of the Improved Model 6245 Balanced Piston 4-Way Master Control Valve is simple and positive. Note the many new and improved features of design and construction in the cut-away view. This Master Control Valve, used in conjunction with Bleeder Valves, has broad flexibility of application in the remote control of air cylinders and devices from conveniently located stations. Control may be by hand, foot, cam, pressure or electric solenoid. Lower view illustrates a remote air operating system in its simplest form. Write for Bulletin 371 giving complete information and diagrams of typical applications.



*Typical Remote Control System*

**LOGANSPORT MACHINE, INCORPORATED**
**911 PAYSON ROAD . . . LOGANSPORT, IND.**
Manufacturers of Air and Hydraulic Devices, Chucks, Cylinders, Valves, Presses and Accessories.



*Rings Around Your Product!*

THIS little group of spring belts, control rings and grease retainers are interesting because of the need for evenness, flexibility and strength. We supply them in every possible gauge, pitch and size—along with several thousand other springs for products. If you do not have it,

**SEND FOR THE PECK CATALOG**

which shows the extent of Peck Service. No charge, but please write on your letter head.

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**AND SCREW MACHINE PARTS**

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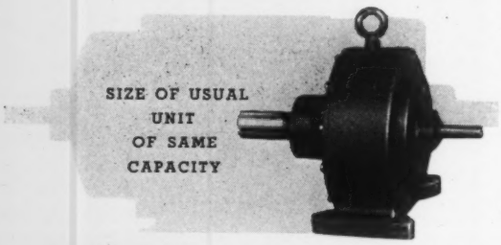
**Nearly TWICE AS COMPACT as Units of Like Capacity**

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*SPEED REDUCER*

*Unlimited ratio* . . . . 20 to 1 or 20 million to 1, in any one housing. Efficiency, 90 to 95%. Range and compactness never before available in any speed reducer. More teeth in action and stronger teeth for a given pitch.

Quiet-running helical gears of best heat-treated alloy steel. *Timken bearings* on high and low speed shafts. Get our low prices! *Send for catalog.*

**WINFIELD H. SMITH, Inc.**

*A Speed Reducer for Every Application*

**16 ELTON STREET, SPRINGVILLE, ERIE COUNTY, N. Y.**

herringbone speed reducers are described and illustrated in a 64-page catalog just issued by Philadephia Gear Works, Philadelphia. Dimensional drawings are included. The catalog also mentions the company's complete line of base plates, couplings and other parts.

STEEL—Stressproof No. 2 cold finished bar steel is discussed in a new bulletin issued by LaSalle Steel Co., Chicago. Advantages such as elimination of heat treating and case carburizing, increase of machining rates and minimizing of warpage are covered fully. Many parts in which this steel has replaced others are shown.

STEEL (ALLOY)—The International Nickel Co. Inc., 67 Wall street, New York, has revised its handy pocket card, "Hardness Conversion Table for Nickel Alloy Steels."

TUBING (FLEXIBLE)—Engineering data of special interest is contained in a new bulletin on Rex-Bellows, 18-8 stainless steel flexible tubing, published by Chicago Metal Hose Corp., Maywood, Ill. Known as bulletin SS-16, the publication shows both divided and fully corrugated forms of tubing, together with couplings. The new pressure and vacuum-tight joint secured by electric resistance welding is also mentioned.

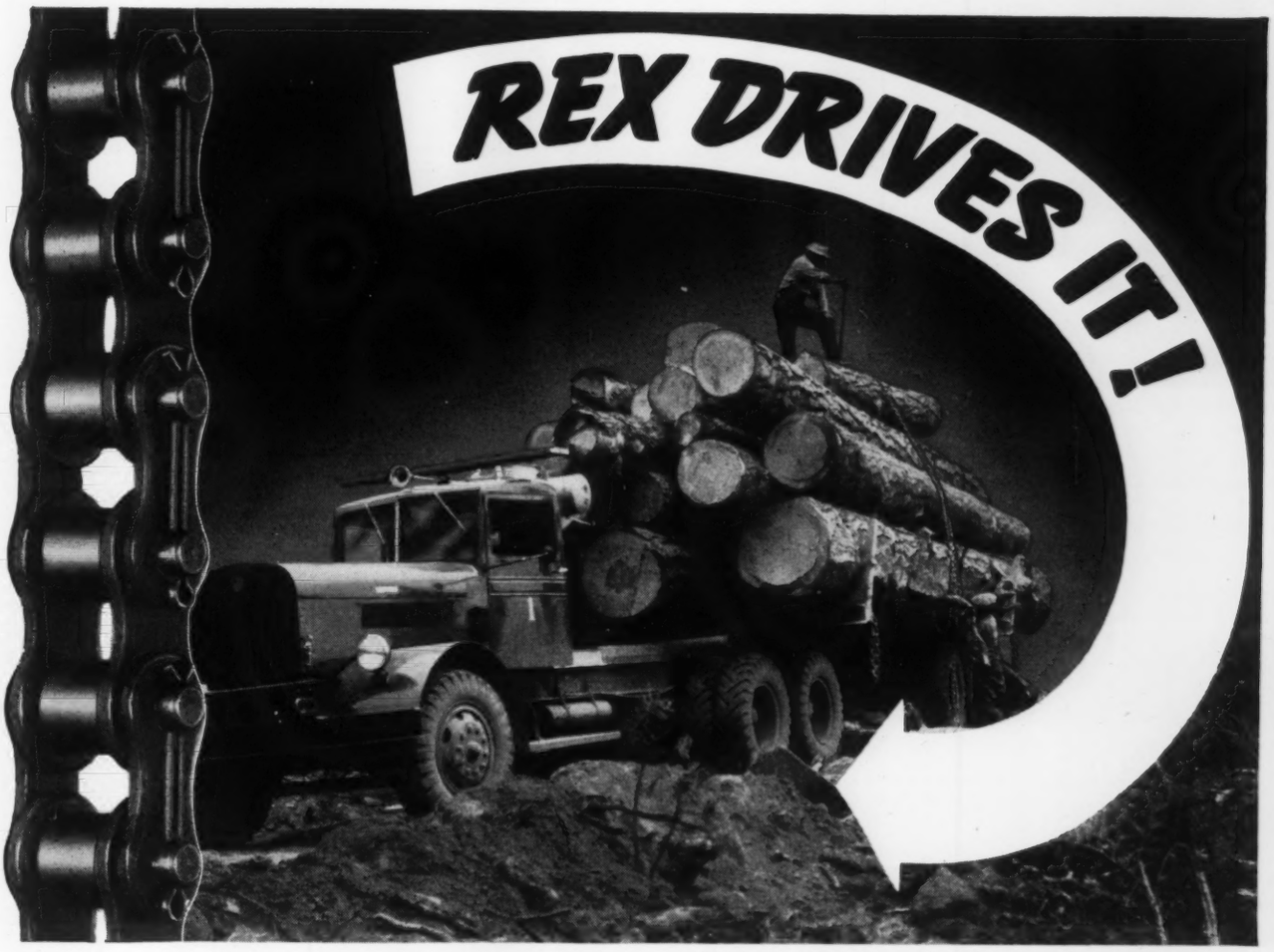
UNIONS (PIPE)—Dualsteel unions (both regular nut and hammer lug nut), standard Rockwood unions with two molybdenum steel seats, and the No. 300 malleable Vulcan unions are described in a new circular issued by Rockwood Sprinkler Co., 38 Harlow street, Worcester, Mass. Strength, toughness, resistance to corrosion are emphasized. Prices and sizes are listed.

VALVES—The Topsy top-seat valve is described in an illustrated folder just issued by The Air Conditioning Supply Co., 4060 Superior avenue, Cleveland. It is suitable for use with humidifiers.

VALVES—Crane Co., Chicago, has prepared a booklet entitled "Service Characteristics of Globe Valves and Gate Valves—How To Pick the Right One Every Time," which is designed to help the user select the proper valve for his particular service. Two charts have been inserted to assist in this purpose.

WELDING EQUIPMENT—Tentative specifications for iron and steel arc-welding electrodes approved by the American Welding society and the American Society for Testing Materials are offered in a 24-page catalog, E-16, issued by the McKay Co., York, Pa. Advice as to selection among different mild-steel electrodes, according to the nature and conditions of the work, is given in charts and comparisons.

WIRE (MAGNET)—Greater information on magnet wire, its electrical and physical properties, and on coils is contained in a new edition of the Magnet Wire catalog published by Anaconda Wire & Cable Co., 25 Broadway, New York. Also available is a small size pocket handbook containing all technical tables of information for the engineer.




# THE REX MAN REPORTS—
# "ONLY CHAIN BELTS WERE THE ANSWER HERE"

"This huge transport is built for carrying lumber from mountain to mill. You can imagine how long gears or direct drives would stand up under the jolts, shocks, twists and heavy loads. Sure, it was a job for chain belts—for only chain belts are positive at all times; only chain belts could take the jolts, jars and frequent overloads normal to this knock-'em-down and drag-'em-out service."

Husky Rex roller chain belts were the choice for this drive! They are used to end similar drive problems on everything from excavators to oil well rigs. The smaller sizes are equally well-known among designers of lighter machines for everything from cake wrapping to paper making.

How to drive it with chain belts involves a lot of tricky questions. The Rex man has the answers. Whether your drives are light or heavy, over long or short centers, high or low speeds, the odds are he can show you how to drive it with less wear, less power loss, less danger from breakdowns. Next time, before designing any drive, write Chain Belt Company, 1643 W. Bruce St., Milwaukee, Wisconsin.

# REX CHAIN BELTS

## CHAIN BELT COMPANY OF MILWAUKEE

*Baldwin-Duckworth Chain Belt Division, Springfield, Massachusetts • Worcester, Massachusetts*
*Rex Chain Belt and Conveyor Divisions, Milwaukee, Wisconsin*

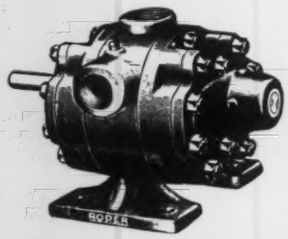
*The Perfect Mixture*

A mixture of power, speed and efficiency properly blended to give more service at lower cost . . . that's Roper Pumps!

As the French chef blends talent with ingredients to make a superior dish, so do Roper engineers, designers and master craftsmen blend knowledge, experience and metals to make a superior pump.

The result is . . . pumps with greater smoothness of operation . . . more power . . . higher speeds . . . lower power consumption . . . and longer life. That's what might be called a large order, but you'll find Roper can fill it! Get the facts and the proof.

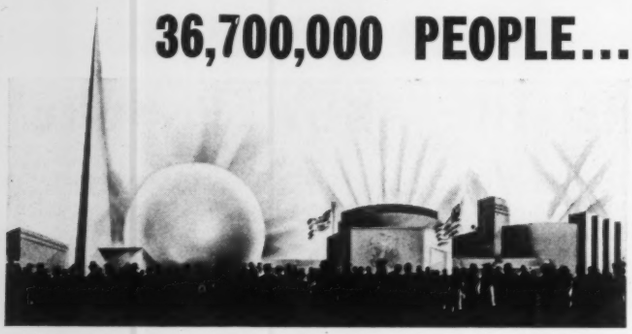
*Write for Bulletin R4MD*



ROPER
Rotary PUMPS
DEPENDABLE SINCE 1857

GEO. D. ROPER CORP., ROCKFORD, ILL.

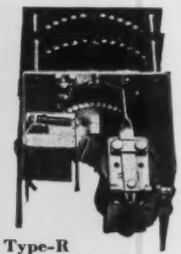
**36,700,000 PEOPLE...**



★ Surging crowds . . . approximately 25,800,000 paid admissions at the New York Fair *plus* another 10,900,000 through the Golden Gate turnstiles. All *Troutman Totalizer counting mechanisms used Relays by Guardian, exclusively, and never missed once!

No interruptions in service from opening to closing, for a total of 439 eighteen-hour days. Moreover, Relays by Guardian were in steady operation 7 days per week, withstanding one of the severest, large scale tests ever made.

*Certified Correct—F. B. Troutman, Pres., Troutman Totalizer Co.



Type-R
Stepping Relay

**RELAYS BY GUARDIAN**

Solenoids—Stepping Switches—Time Delay—AC—DC

singly, or in COMPLETE CONTROL UNIT form, have answered thousands of problems. They answer yours, too, with a quick solution and a delivery date a lot closer than you'd ever expect.

*Write for Catalog "D" Today!*

GUARDIAN ELECTRIC
1621 W. Walnut St. Chicago, Illinois

# Business and Sales Briefs

IN ADDITION to being sales manager, R. B. Nichols has been elected secretary of the Bantam Bearings Corp., South Bend, Ind. Mr. Nichols has been associated with the bearing business for the last fifteen years, most of which were spent with the Bantam company.

♦

In view of increased business in its line of brass, bronze, aluminum and other castings, Waukesha Foundry Co., Lincoln avenue, Waukesha, Wis., is enlarging its quarters by a one-story addition.

♦

J. C. Keyworth who has had considerable experience in the bolt and nut industry has joined the sales staff in the Midwest territory of Lamson & Sessions Co., Cleveland. Formerly he was connected with Triplex Screw Co.

♦

Appointment of C. H. Vaughn, 1112 South Twenty-sixth street, Birmingham, Ala., as representative in the southeastern states has been announced by Allegheny Ludlum Steel Corp.

♦

For the past eight years vice president and sales manager of Link-Belt Co., Pacific division, San Francisco, Ralph M. Hoffman has been appointed assistant to the president of the parent organization with headquarters at the company's head office in Chicago.

♦

The business of Rock River Machine Co., Janesville, Wis., has been acquired by Hannifin Mfg. Co., Chicago, manufacturers of hydraulic and pneumatic equipment. Engineering, sales and manufacturing activities will be continued at Janesville, Wis.

♦

Formerly executive vice president, Charles E. Wilson has been elected president of General Electric Co.; and Phillip D. Reed, assistant to the president, has been made chairman of the board of directors of the company. Mr. Wilcox and Mr. Reed succeed Gerard Swope and Owen D. Young who will become honorary president and honorary chairman of the board, respectively.

♦

W. A. Barr, vice president in charge of manufacturing of Foote Bros. Gear & Machine Corp., Chicago, has been elected executive vice president and general manager. F. H. Fowler, president and general manager of the company has resigned to accept a position as assistant to the president and chief operating executive of The American Machine & Metals Inc. Mr. Fowler will continue as director and chairman of the

# Felt...

## —the Universal MATERIAL

Every day, designers and plant men, faced with a new or unusual problem, are finding the answer in felt. Working closely with Western's research laboratories, these men have discovered highly specialized uses for felt with greater efficiency and economy. Among the more common uses for felt are in vibration absorption, sound deadening, heat insulating, sealing bearings, conveying lubricants, filtering liquids.

*Wherever you are, Western's complete laboratory facilities and 41 years of practical experience are yours for the asking, with no obligation.*

**Western Industrial Felt Service**

**WESTERN FELT WORKS**

**4037-4117 Ogden Avenue Chicago, Illinois**

***Largest Independent Manufacturers and Cutters of Wool, Hair and Jute Felts. Established 1899.***

**BRANCH OFFICES IN ALL PRINCIPAL CITIES**



# THEY CAN "TAKE IT"!

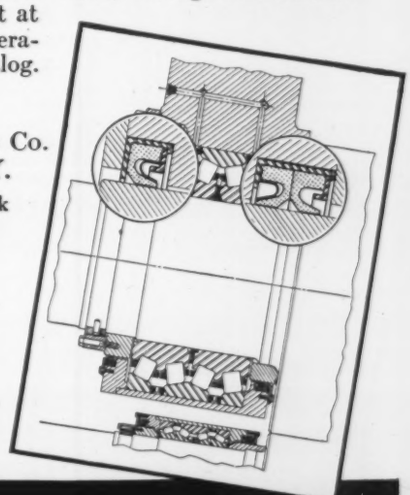
## C —So Can KLOZURE Oil Seals

*PATENTED*

DRAGGING a heavy sledge over the ice and snow of the Arctic, a team of "huskies" will cover 60 miles day after day under the most trying conditions. The GARLOCK KLOZURE Oil Seal can "take it," too, under the most trying conditions—on "roll necks" in the steel mills, for instance, to mention only one of many successful applications in severe service. The exclusive GARLOCK compound from which the KLOZURE seal is made, is tough and durable—resists oil and heat at high or low temperatures. Write for catalog.

THE GARLOCK PACKING CO.
PALMYRA, N. Y.

In Canada: The Garlock Packing Co. of Canada Ltd., Montreal, Que.



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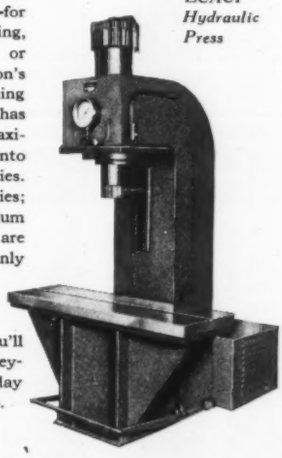
# LET DENISON HELP SOLVE YOUR SPECIAL MACHINERY PROBLEMS!

## NEW, ECONOMICAL HYDRAULIC PRESSES

***For All Smaller Press Jobs***

A completely new series of rugged, dependable hydraulic presses at low cost—for small-capacity straightening, assembling, broaching or other press jobs. Denison's long experience in designing special hydraulic presses has enabled them to build maximum operating efficiency into this new standard-type series. 5-to 50-ton working capacities; 26" stroke; 29" maximum vertical opening. They are compact, complete; only power connections and oil for the reservoir are required to put these presses into operation. You'll want details on these money-saving presses. Write today for special bulletins No. 101 and 102.

*Denison ECACI Hydraulic Press*



# DENISON

*Engineering Company*

106 WEST CHESTNUT STREET COLUMBUS, OHIO

# WALDRON Flexible COUPLINGS

*a Type and Size for Every Purpose*

GEAR TYPE
Standard Torque Ring
FRANCKE
Standard Marine
SPECIAL Types

Most complete line of forged steel couplings for all drives, all loads. Advanced design and construction improvements insure trouble-free operation. Low initial cost. Write for catalogs giving sizes, service factors, prices. No obligation.

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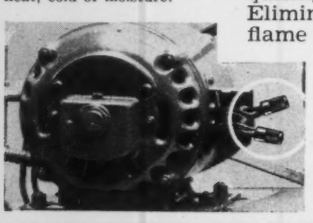
ALL TOGETHER....
COSTS DOWN
QUALITY UP WITH
IDEAL
Wire-Nuts

¼" moulded composition shell, puncture proof at 10,000 volts. Unaffected by heat, cold or moisture.

Better electrically—stronger mechanically, IDEAL "Wire-Nuts" make wire joints faster than solder and tape method . . . cut production material costs . . . boost quality. Thread onto skinned wires as quickly as a nut threads on a bolt. Eliminates special tools and open-flame hazards. Write for details.



**Fully Approved—Listed by Underwriters' Laboratories, Inc.**

**SAMPLES UPON REQUEST**

Millions of IDEAL "Wire-Nuts" are being used by electrical appliance manufacturers.

Electrical Products Division
**IDEAL COMMUTATOR DRESSER COMPANY**
1059 Park Avenue Sycamore, Illinois


executive committee of the Foote Bros. company. F. A. Emmons, vice president in charge of sales of Foote Bros., and J. R. Fagan, secretary and treasurer, will continue in their present capacities.

Another appointment by the company is that of H. J. Braun, recently placed in charge of sales of the steel specialties division of the company. Mr. Braun replaces H. G. Hobbs, formerly in charge of sales in this division.

♦

New representative for Cutler-Hammer in the Omaha territory is Clayton P. Innes who has had many years of field experience in the application of motors and motor control for every type of service.

♦

McKay certified stainless steel electrodes will in the future be handled by all the branches of Joseph T. Ryerson & Son Inc., Chicago.

♦

A new addition to provide more adequate facilities is being built by Standard Pressed Steel Co., Jenkintown, Pa., manufacturers of socket screws.

♦

Opening of a new warehouse has been announced by Wheelock, Lovejoy & Co. Inc., Cambridge, Mass., to handle a stock of Hy-Ten steels and SAE alloy steels. The warehouse is located at 4524 West Mitchell avenue, Winton Place, Cincinnati.

♦

Appointment of R. L. Johnstone as manager of the shaker division of Ajax Flexible Coupling Co., Westfield, N. Y., has recently been made. Mr. Johnston has had considerable experience in all phases of design, manufacturing and sales of screening, conveying and feeding equipment, and is widely known as an authority on its application.

♦

John S. Barnes Corp., Rockford, Ill., manufacturer of hydraulic equipment, has appointed W. H. Blackmer of Larchmont, N. Y., as sales engineer in the New England and metropolitan New York area; and Bryant Machinery & Engineering Co., Daily News building, Chicago, in the Chicago territory.

♦

Previously district sales manager in Atlanta, Ga., for Page Steel & Wire division of American Chain & Cable Co., Bridgeport, Conn., R. J. Teeple has been made district sales manager for the division at New York, with headquarters at 230 Park avenue. S. R. Hawkins who was connected with the Pittsburgh office of the company, will be Mr. Teeple's successor at Atlanta.

♦

Additional appointments have been made by General Electric Co. These are: L. T. Blaisdell, commercial vice president since 1936 with headquarters in Dallas, Texas, has been named manager of the East central district, succeeding the late W. J. Hanley. W. B. Clayton, manager and assistant district manager of the central station department of the company, succeeds Mr. Blaisdell in Dallas as manager of the southwestern district. Succeeding A. L. Pond as

A New Line . . .

the 500 Series ROTARY GEARED PUMPS

with HERRINGBONE GEARS

—Quiet in operation
••• for pressures up to 500 lbs.

Ask for circular

Brown & Sharpe Mfg. Co.,
Providence, R. I., U. S. A.

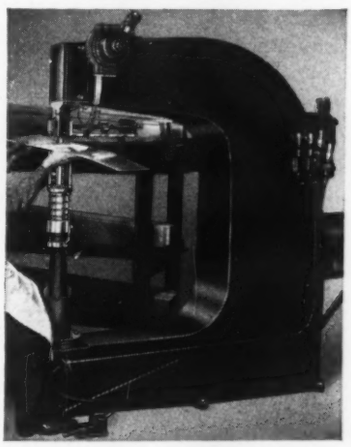
BROWN & SHARPE
B·S PUMPS



comes now . . .

*SPEED of control*
*in* **HYDRAULIC OPERATIONS**

Speed of reaction without sacrificing efficiency is now being had by pneumatically controlling hydraulic power valves. There is an important saving in reaction time of pneumatic controls over the comparatively slower hydraulic reaction in identical circuits.



**T-J Pneumatic Remote Controls provide full advantage of this saving also in that their variety of unit types permit their application to your requirements to be of standardized equipment.**

**Bulletin number RC-4 reports on the high points of these systems in this application type as well as in many others in which they are being successfully and increasingly used. Your copy will be sent promptly upon receipt of your request.**

**T-J Controls** are shown here on a T-J Hydraulic Rivitor. Developed for riveting aircraft fuselage and wing sections, the operator's station is necessarily some distance from the power valve. T-J Pneumatic Controls provide the desired snappy reaction to the power valve.

*this is a* **TOMKINS-JOHNSON** *product*

**factory at 618 N. Mechanic St., Jackson, Michigan. Agents in principal cities. T-J Products also include Air and Hydraulic Cylinders . . . Rotating Chucks and Cylinders . . . Rivitors . . . Clinchors . . . Special Equipment . . . Brownie Coolant Pumps . . . T-J Die Sinking Milling Cutters.**

**HERE'S YOUR CHANCE TO TRY BRUNING RIVAL!**

Of the world's two top-ranking tracing cloths, one is made abroad. The other—Bruning RIVAL—is now being made in America . . . made to the same exacting standards that have won it fame wherever fine quality is recognized. Available quickly at your call, Bruning Rival Tracing Cloth is ready to show you—on your own drafting board—why you cannot buy a better cloth at any price. Here are the reasons why Rival stands first in preference with so many thousands of draftsmen:

**TOP FLIGHT FOR UNIFORMITY**

Owing to modern machinery and rigid inspection, Rival has absolute uniformity of working surface. One roll of Rival is just like the next!

**TOP FLIGHT FOR TRANSPARENCY**

Rival has just the right degree of transparency—a transparency which is obtained without the use of surface oils that would cause the cloth to become opaque and brittle with age.

**TOP FLIGHT FOR ERASING**

Rival is famous for its excellent erasing qualities, equaling or surpassing any tracing cloth on the market in its ability to stand repeated erasures as comparative tests will show.

**TOP FLIGHT FOR DURABILITY**

Rival Tracing Cloth has exactly the right thread count for maximum durability. Too fine a cloth would sacrifice strength . . . too coarse a cloth would cause "pin holes" in the sizing. Rival's base fabric is BALANCED for all-around satisfaction.

**TOP FLIGHT FOR PREFERENCE**

Rival passes hardest tests for uniformity of working surface, durability, transparency, erasing and tensile strength. Available in 24-yard rolls, standard widths from 24" to 54" wide—rolled on large cores to eliminate end curl. Also available in cut sheets printed to your own specifications. Costs no more than any other top grade tracing cloths.

**TRY A FREE SAMPLE!** The coupon will bring you a working sample of Bruning Rival. Mail the coupon.

**BRUNING** *Since 1897*

**SPEEDS—SIMPLIFIES—AND PROTECTS A NATION'S DRAFTING**

CHARLES BRUNING CO., Inc. - New York: 100 Reade Street
Chicago: 445 Plymouth Court - Los Angeles: 818 Santee Street

I want to try Bruning Rival—America's premier tracing cloth, without cost or obligation. Please send me a generous working sample.

*Name*_____

*Address*_____

*City*_____ *State*_____ 983-170

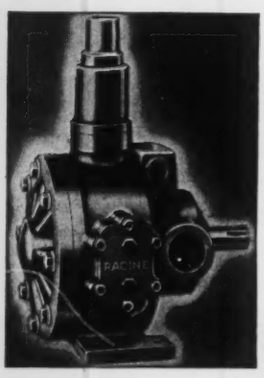
# RELAYS WITH PEP

The conciseness, characteristic of all Ward Leonard Relays, is due to sound engineering and careful workmanship. The very attributes that impart precision assure ruggedness and long life. Ward Leonard Relays are made in a wide variety of sizes, types and contact arrangements. Send for Bulletins describing relays of interest to you.

**WARD LEONARD**
**ELECTRIC COMPANY**
**45 SOUTH STREET, MOUNT VERNON, N. Y.**
*ELECTRIC CONTROL DEVICES SINCE 1892*

# RACINE

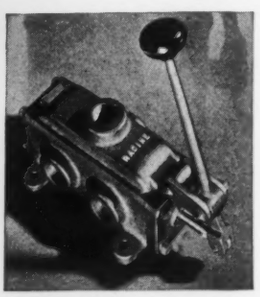
**Variable Volume Hydraulic Pumps**



Extremely quiet, smooth performance. A thoroughly proven, efficient pump for pressures up to 1000 lbs. per sq. inch. Capacities 2000—4000—6000 cubic inches per minute.

The Variable Volume feature saves horse-power. Delivers amount of oil actually required. Volume is controlled automatically or manually.

*Write for new catalog P-10*



**Racine Hydraulic Valves**

A complete line—manual—pilot or electrically operated. Balanced pistons—Accurately fitted.
For oil-hydraulic installations.

*Write for new catalog V-10*

**RACINE TOOL & MACHINE CO.**
**1773 State St. Racine, Wis.**


manager of the company's office in Milwaukee, is P. Y. Tumy, formerly in charge of the Grand Rapids office. Mr. Tumy is replaced by Merritt Lawrence at Grand Rapids, Mich.

♦

Hydro-Power Systems Inc., Mount Gilead, Ohio, manufacturer of hydraulic machine drives, has transferred its general office to Pittsburgh.

♦

Several additions have been made to the sales staff of the mechanical division of B. F. Goodrich Co. I. N. Kimsey has been named manager; R. A. Charlton, assistant manager of the Akron sales division; J. S. Gulledge, manager of the St. Louis district; and A. M. Finala, product sales manager of the air-cell division, devoted to sales of the company's new latex cushioning material.

♦

Advancement of Louis H. Brendel to assist C. H. Butterfield, general sales manager of Manning, Maxwell & Moore Inc., Bridgeport, Conn., manufacturers of pressure gages, safety valves, thermometers, etc., has recently been announced.

♦

Wheelco Instruments Co., Chicago, has appointed Rodgers Engineering Co., 204 Thomas building, Dallas, Texas, as its representative in the North Texas territory.

♦

Formerly Pittsburgh district manager of Lebanon Steel Foundry, Lebanon, Pa., Warden F. Wilson has been appointed general manager of sales for the company.

♦

V. L. Graf Co., Detroit, Mich., has moved into its own plant at 9456 Grinnell avenue, to manufacture an extensive line of steel hydraulic tube fittings, hose couplings and hydraulic accessories.

♦

Recent announcement has been made of the appointment of H. M. Cherry as manager of metal finishing sales for A. T. Wagner Co., 2700 Wight street, Detroit.

♦

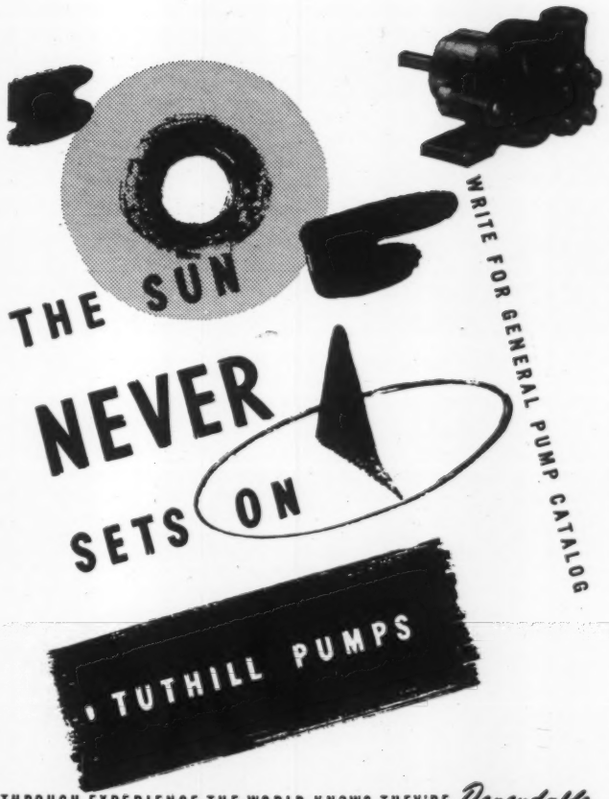
With headquarters at 30 East Forty-second street, New York, A. B. Hoefer will represent the Udylite Corp., Detroit, Mich., as eastern district manager. L. J. George, sales engineer, has been transferred from the Cleveland branch to the New York office of the company.

♦

According to a recent announcement by Joseph B. Kushner, chief engineer and founder of Personalized Plating Service, the company has moved to its new quarters at 192 Broadway, New York, in order to give increased service to the electroplating and finishing industry.

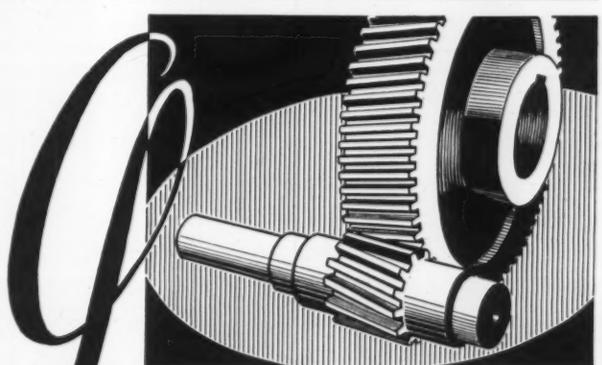
♦

An addition is being made to the plant of Hoosier Lamp & Stamping Co., Oakley and Morgan streets, Evansville, Ind., manufacturers of metal products and stamped metal goods.




THROUGH EXPERIENCE THE WORLD KNOWS THEY'RE *Dependable*

TUTHILL PUMP COMPANY • 941 EAST 95TH STREET • CHICAGO, ILL.



# Gears THAT IMPROVE MACHINE OPERATION

You will get longer life, better machine operation when you use Abart Cut Gears. They perform with ease, operate smoothly and without vibration, with each tooth engaging precisely at each revolution. No stocks. Made only to your B/P or specifications, delivered on time and at the right price. Consult our engineers on your gear problems and send specifications for estimate.

**SPEED REDUCERS.** Many types and sizes in stock for immediate delivery. Write today for the new Abart Speed Reducer catalog.

Abart GEAR AND MACHINE CO.
MANUFACTURERS OF
Speed Reducers & Gears
4821 WEST 16TH ST. CHICAGO ILLINOIS

## THE POINT THAT WILL REDUCE YOUR MACHINERY MAINTENANCE COSTS

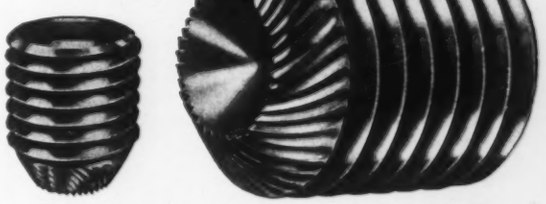


Fig. 1645 Pat's. Pend'g

Fig. 1641 Pats. Pending

# UNBRAKO

## SELF-LOCKING HOLLOW SET SCREWS with the Knurled Points

No ordinary set screws, these, nor do they permit the continual maintenance check-ups necessary wherever ordinary set screws are used. "Unbrako" Self-Locking Hollow Set Screws with the Knurled Points just can't do that. For once set up these screws automatically lock into place and will not shake loose under the severest vibration. They're easy to turn into place, too . . . the ingenious knurling that insures locking protection offers no resistance during the operation. And removal or adjustment can be made at any time with the ordinary hex bar wrench. Also, "Unbrakos" can be used over again any number of times with the same effectiveness.

Our catalog gives full information—write for it and for samples.

**"UNBRAKO" SQUARE HEAD SELF-LOCKING SET SCREWS**

guarantee this same unfailing protection which, together with high strength and uniform accuracy, gives them undeniable superiority. Try them and see for yourself.

Fig. 1646 Pat's. Pend.

**STANDARD PRESSED STEEL CO.**

BRANCHES BOSTON DETROIT INDIANAPOLIS — JENKINTOWN, PENNA. BOX 102 — BRANCHES CHICAGO ST. LOUIS SAN FRANCISCO

# NEW MACHINES—
## And the Companies Behind Them

*(For illustrations of other outstanding machinery see Pages 56-57)*

### Air Conditioning

Deluxe domestic stoker, Whiting Corp., Harvey, Ill.
One-hundred ton compressor, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

### Bakery

Automatic doughnut unit, F. W. Stock & Sons Inc., Hillsdale, Mich.

### Bottling

Soaker type bottle washer, Dostal & Lowey Co., Menominee Falls, Wis.
Bottle washer, The Heil Co., Milwaukee.

### Construction

Speeder shovel, The Link-Belt Co., Chicago.
Truck mixers and agitators, T. L. Smith Co., Milwaukee.

### Dairy

Cold milk filter, Dombrow Bros. Co., Fond du Lac, Wis.
Viscolizer, Cherry-Burrell Corp., Chicago.
Dry cooler, Beverage Vending Machines Inc., Kansas City, Mo.

### Domestic

Refrigerators, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Electric water heater, Edison General Electric Appliance Co. Inc., Chicago.
Electric scissors, General Transformer Co., Chicago.
Oil burner, General Electric Co., Air Conditioning Div., Bloomfield, N. J.
Spinner washer, Blackstone Mfg. Co. Inc., Jamestown, N. Y.

### Food

Vacuum mixer, Read Machinery Co., Reading, Pa.
Centrifugal for clarifying chocolate, American Laundry Machinery Co., Cincinnati.
Clarifier, Dorr Co., New York.
Locker plant freezing unit, Baker Ice Machine Co., Omaha, Nebr.
Water cooler, York Ice Machinery Co., York, Pa.
Food and meat scale, Griffith Laboratories, Chicago.
Small pulverizer, Pulverizing Machinery Co., Roselle, N. J.
Filtration unit, T. Shriver Co., Harrison, N. J.

### Forging

Steam drop hammer, Chambersburg Engineering Co., Chambersburg, Pa.

### Foundry

Molding machine, The Adams Co., Dubuque, Ia.

### Metalworking

Hydraulic metal marking press, Charles F. Elmes Engineering Works, Chicago.
Cutting machine, Air Reduction Sales Co., New York.

### Mining

Mineral and other materials separating machine, Sutton, Steels & Steel Inc., Dallas, Tex.
Dust precipitator, American Air Filter Co., Louisville, Ky.

### Printing

Automatic cylinder press, Miller Printing Machinery Co., Pittsburgh.
Cutter, Harris-Seybold-Potter Co., Dayton, O.
Power cutter, Chandler & Price Co., Cleveland.
Folding machines, Dexter Folder Co., Pearl River, N. Y.

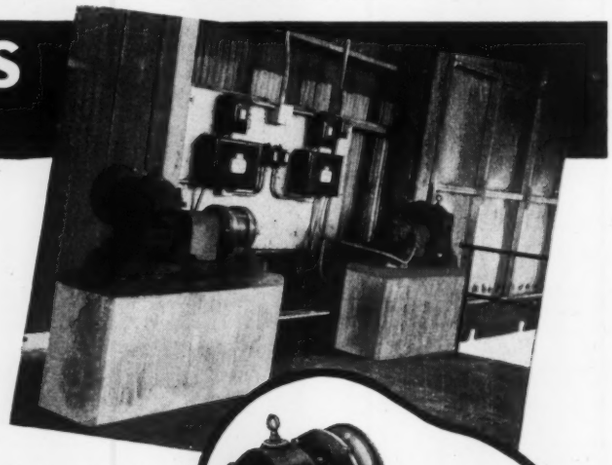
### Restaurant

Meat and vegetable cutting machine, Roto-Cut Corp., Cleveland.
Water cooler, Cordley & Hayes, New York.
Vegetable peeler, Reynolds Electric Co., Chicago.

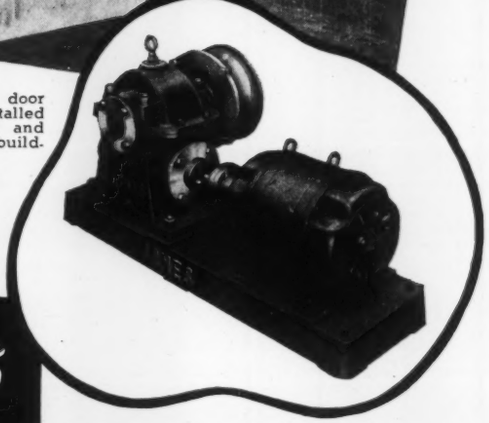
### Textile

Reel dyeing machine, H. W. Butterworth Sons Co., Philadelphia.
Package dyeing machine, Venango Engineering Co., Philadelphia.
Three-roll hydraulic calender, Textile Finishing Machinery Co., Providence, R. I.
Shuttleless loom, J. F. Timberlake, Charlottesville, Va.
Rotary cutter, Automatic Air Doffer Co., Everett Mills, Lawrence, Mass.
Extractor, Tolhurst Centrifugal Div., American Machine & Metals, East Moline, Ill.
Machine for covering rubber yarn, H & B American Machine Co., Pawtucket, R. I.
Full-fashioned knitting machine, Textile Machine Works, Reading, Pa.
Pattern-wheel rib machine, Jacquard Knitting Machine Co. Inc., Philadelphia.
Automatic blending feeder, Lummus Cotton Gin Co., Columbus, Ga.
Small-lot extractor, Horing & Stephens Co., Paterson, N. J.
High-speed fagotting stitch machine, Abe Gellman, New York.


# JONES DOOR HOISTS
## for handling furnace doors



Two Jones door hoists as installed for opening and closing mill building doors



● Here is a simple, compact and sturdy heavy duty worm gear driven door hoist that has been widely used in the steel industry for handling furnace doors. It is also applicable to other services where doors of various types must be opened and closed and where it is desired to avoid the complications of limit switches.

With the Jones door hoist there is not the slightest hazard created by the possibility of over-travel. When the door is opened, if the motor is not stopped, a bronze ring on the winding drum slips and no damage can result . . . When the door is closed, the bronze ring again slips until the motor is stopped.

Thus the Jones door hoist automatically prevents over-winding and eliminates the necessity for expensive limit switches, brakes, or other electrical apparatus designed to prevent over-winding that might be dangerous or damage the equipment. Consequently this drive is simple, economical and fool-proof in its operation.

These door hoists are built by Jones as complete units with motor included if desired, or with base to take standard motor, as supplied by the purchaser.

If you have a door handling problem, our engineering department will be pleased to make a recommendation covering a unit that will handle it.

**W. A. JONES FOUNDRY & MACHINE CO.**
**4413 Roosevelt Road, Chicago, Illinois**

Jones Since 1890

HERRINGBONE—WORM—SPUR—GEAR SPEED REDUCERS • CUT AND MOLDED TOOTH GEARS • V-BELT SHEAVES
ANTI-FRICTION PILLOW BLOCKS • PULLEYS • FRICTION CLUTCHES • TRANSMISSION APPLIANCES

Jones door hoists are built in several ratings and may be installed in almost any convenient arrangement of sheaves and cables. Base will take any standard motor. **NO LIMIT SWITCHES OF ANY KIND REQUIRED WITH THIS UNIT.**

THE ONE SPRING most perfectly suited to your requirements . . . sifted out . . . rigidly pretested for the specific properties needed . . . produced with unfailing accuracy . . . guarantees perfect performance of your design . . . are the reasons why leading designers rely on Hunter!

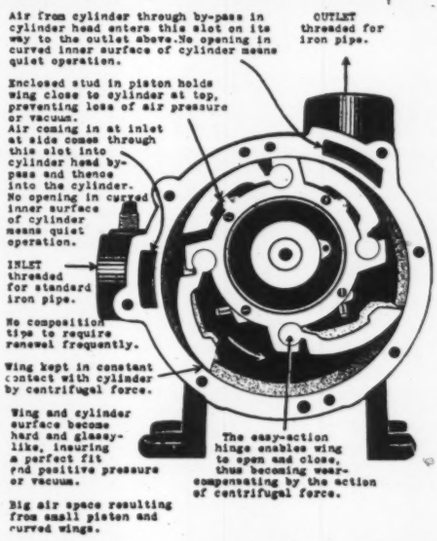
● STAMPINGS
● WIRE FORMS

HUNTER SPRINGS - STAMPINGS

Springs by Hunter

HUNTER PRESSED STEEL CO., LANSDALE, PA.

**Standard Equipment on all sorts of Air Using Devices and used by the world's leaders . . . . .**


Air from cylinder through by-pass in cylinder head enters this slot on its way to the outlet above. No opening in curved inner surface of cylinder means quiet operation.
OUTLET threaded for iron pipe.
Enclosed stud in piston holds wing close to cylinder at top, preventing loss of air pressure or vacuum.
Air coming in at inlet at side comes through this slot into cylinder head by-pass and thence into the cylinder. No opening in curved inner surface of cylinder means quiet operation.
INLET threaded for standard iron pipe.
No composition tips to require renewal frequently.
Wing kept in constant contact with cylinder by centrifugal force.
Wing and cylinder surface become hard and glassy-like, insuring a perfect fit and positive pressure or vacuum.
Big air space resulting from small piston and curved wings.
The easy-action hinge enables wing to open and close, thus becoming wear-compensating by the action of centrifugal force.

**LEIMAN BROS. PATENTED ROTARY AIR PUMPS**
PRESSURE
VACUUM
for use with
**GAS AND OIL BURNERS**

**PAPER FEEDERS**
Vacuum Printing Frames
Bottle Fillers
**GAS MACHINES**
**AUTOMATIC DEVICES**
**MANY SIZES**

**A Machine That Takes Up Its Own Wear Automatically**

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**LEIMAN BROS.** 23-P3A Walker St. NEW YORK CITY

*MAKERS OF GOOD MACHINERY FOR 50 YEARS*

RICHARDSON

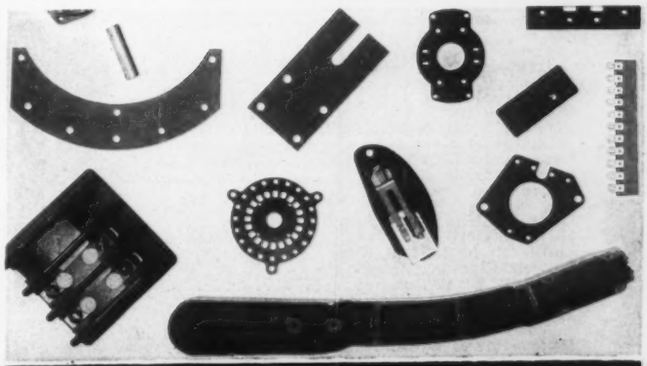
*Precision*

PLASTICS

Large buyers of plastics, in their choice of INSUROK, have rendered a distinct service to those who are using plastics for the first time. Faced with the question—"What plastic shall I use?"—their answer, after extensive research and investigation, was "INSUROK, the precision Richardson plastic!" Let their experience save you time and money! After *your* first use of INSUROK you'll agree their decisions were wise and profitable.

***LAMINATED and MOLDED***

**INSUROK**



*The* RICHARDSON COMPANY

MELROSE PARK (CHICAGO) ILL. FOUNDED 1858 LOCKLAND (CINCINNATI) OHIO
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